

NOTIFICATION OF ADDENDUM

ADDENDUM NO. 1

DATED 5/25/2006

Control	0017-09-072, ETC.
Project	BR 2006(590), ETC.
Highway	IH 35
County	BEXAR

Ladies/Gentlemen:

Attached please find an addendum on the above captioned project. Included in the attachment is an addendum notification which details the changes and the respective proposal pages which were added and/or changed.

Except for new bid insert pages, it is unnecessary to return any of the pages attached.

Bid insert pages must be returned with the bid proposal submitted to the Department, unless your firm is submitting a bid using a computer print out. The computer print out must be changed to reflect the new bid item information.

Contractors and material suppliers, etc. who have previously been furnished informational proposals are not being furnished a copy of the addendum. If you have a subcontractor on the above project, please advise them of this addendum. Acknowledgment of this addendum is not requested if your company has been issued a proposal stamped "This Proposal Issued for Informational Purposes."

You are required to acknowledge receipt of this addendum by entering the date, which appears at the top of this letter on the Addendum Acknowledgement Form, contained in your bid proposal.

Failure to Acknowledge receipt of this addendum in your bid proposal will result in your bid not being read.

04/99

SUBJECT: PLANS AND PROPOSAL ADDENDUMS

PROJECT: BR 2006(590)

CONTROL: 0017-09-072

COUNTY: BEXAR

LETTING: 06/09/2006

REFERENCE NO: 0522

PROPOSAL ADDENDUMS

PROPOSAL COVER

X BID INSERTS (SH. NO.: 1-22 THRU 22-22)

X GENERAL NOTES (SH. NO.: 1-4, 3-4)

X SPEC LIST (SH. NO.: 1-4, 3-4 AND 4-4)

X SPECIAL PROVISIONS:

ADDED: 003-020, 006-020, 100-001, 260-001, 360-003, 500-002
502-022

DELETED:

X SPECIAL SPECIFICATIONS:

ADDED: 5344, 5345, 6439, 6447, 6446, 6441, 6431, 6440, 6448

DELETED:

X OTHER: PLAN SHEETS:4-9,12-12C,40,45,47,51,52,53,64,66,69-75,77,80-87,
89-95,120-149,186-193,207A-214,215-219,219JJ,224A,224B,17,19ETC

DESCRIPTION OF ABOVE CHANGES

(INCLUDING PLANS SHEET CHANGES)

BID INSERTS

SHEET 1-22- DELETED ITEMS 100-2010,104 2001,104 2009,104 2015,104 2017,
104 2023. ADDED ITEM 100 2002.

SHEET 2-22- ADDED SPECIAL PROVISIONS 260 001 AND 360 003.
ADDED ITEMS 260 2006, 340 2106, 361 2001, AND 361 2003
DELETED ITEMS 260 2007, AND 340 2033.
CHANGED QUANTITY FOR ITEM 168 2001

SHEET 3-22- SHIFTED DUE TO ABOVE CHANGES

SHEET 4-22- CHANGED QUANTITY FOR ITEM 423 2009

SHEET 5-22 - CHANGED QUANTITY FOR ITEM 450 2013.

SHEET 6-22 - DELETED ITEMS 496 2002 AND 496 2018.

ADDED SPECIAL PROVISIONS 500 002 AND 502 022.

CHANGED QUANTITY FOR ITEMS 512 2065, 512 2066,512 2067,
AND 514 2005.

SHEET 7-22 - CHANGED QUANTITY FOR ITEMS 514 2006 AND 514 2022

SHEET 8-22 - CHANGED QUANTITY FOR ITEM 540 2011.

DELETED ITEMS 542 2001,542 2002,544 2012

SHEET 9-22 - ADDED ITEMS 610 2047, 610 2060,618 2018,618 2035,618 2052,
AND 620 2004.

CHANGED QUANTITY FOR ITEMS 618 2029 AND 618 2046

DESCRIPTION OF ABOVE CHANGES

(CONTINUED)

(INCLUDING PLANS SHEET CHANGES)

DELETED ITEM 550-2003

SHEET 10-22 - ADDED ITEMS 620 2011 AND 628 2003.
CHANGED QUANTITY FOR ITEMS 620 2012, 620 2013, AND 628 2158
DELETED ITEM 628 2075.
SHEET 11-22 - SHIFTED DUE TO ABOVE CHANGES.
SHEET 12-22 - CHANGED QUANTITY FOR ITEMS 650 2173 AND 652 2002.
SHEET 13-22 THRU 21-22 - SHIFTED DUE TO ABOVE CHANGES.
SHEET 22-22 - ADDED ITEMS 6439 2001, 6447 2001, 6447 2002, 6447 2003,
6447 2004, 6447 2005, 6441 2001, 6446 2001,
6431 2011, AND 6440 2001.

SPECIFICATION LIST

SHEET 1-4 - DELETED ITEM 104
SHEET 2-4 - DELETED ITEMS 496, 542, AND 550
SHEET 3-4 - ADDED SPECIAL PROVISIONS 003-020, 100-001, 260-001, 360-003
006-020, 500-002, AND 502-022.
SHEET 4-4 - ADDED SPECIAL SPECIFICATIONS 6439, 6447, 6441, 6446, 6431, 6440

GENERAL NOTES

SHEET A (PLAN SHT. 10) ADDED A RATE TO ITEM 260 ON BASIS OF ESTIMATE
SHEET J (PLAN SHT. 10D) - CHANGED FROM SIX DAY TO FIVE DAY WORKWEEK.
SHEET V (PLAN SHT. 10J) - ADDED "POLE 04" NOTE TO ITEM 610 NOTES.
SHEET W (PLAN SHT. 10J) - ADDED "TEEX04" AND "BARRIER" NOTES TO ITEM 618.
SHEET X (PLAN SHT. 10K) - ADDED "BREAKAWAY04" NOTE TO ITEM 620.
DELETED SECOND AND THIRD PARAGRAPHS UNDER ITEM 628.
SHEETS Y THRU FF (PLAN SHTS. 10L-100) - SHIFTED DUE TO ABOVE CHANGES.

PLAN SHEETS

SHEETS 4 THRU 5 - INDEX ALTERED WHERE INDICATED.
SHEET 6 - CHANGED "1" ASPH STAB BASE (BOND BREAKER)" TO "ASPH SEAL"
IN LEGEND.
SHEETS 7 THRU 9 - CHANGED "1" ASPH STAB BASE (BOND BREAKER)" TO "1" HOT MIX
TY-D" IN LEGEND.
SHEETS 12 THRU 12C - REVISED QUANTITIES.
SHEETS 11 THRU 11D - REVISED QUANTITIES AND CHANGED FORMAT OF SHEET.
SHEETS 17 AND 19 - REVISED WHERE INDICATED.
SHEETS 40, 45, 47, 51 THRU 53 - REVISED QUANTITIES
SHEETS 64 - REVISED WHERE INDICATED
SHEET 66 - DELETED NOTE NUMBER 13.
SHEET 69 THRU 71 - ADDED NOTE WHERE INDICATED.
SHEETS 72 THRU 75 - CHANGED SHEET TOTALS TABLE WHERE INDICATED.
SHEETS 77, 80 THRU 87, 89 THRU 92 - CHANGED SHEET TOTALS TABLE WHERE
INDICATED.
SHEET 93 - CHANGED SHEET TOTALS TABLE WHERE INDICATED AND ADDED SEDIMENT
CONTROLLED FENCE WHERE INDICATED.
SHEET 94 - DELETED NOTE CONCERNING LOCATION OF TRUCK EXIT AND ADDED
SEDIMENT CONTROLLED FENCE WHERE INDICATED
SHEET 95 - ADDED SEDIMENT CONTROLLED FENCE WHERE INDICATED.
SHEET 120 THRU 149 - CHANGED SHEET TOTALS TABLE.
SHEET 186, 187, 188 THRU 193 - CHANGED SHEET TOTALS TABLE.
SHEET 207A THRU 207B - ADDED
SHEET 208 THRU 210 - CHANGED BEGINING POINT FOR RETAINING WALL AND CHANGED
THE HORIZONTAL CONTROL DATA FOR THE RETAINING WALL.

SHEET 211 - CHANGED BEGINNING POINT FOR RETAINING WALL AND CHANGED THE
DESCRIPTION OF ABOVE CHANGES (CONTINUED)
(INCLUDING PLANS SHEET CHANGES)

HORIZONTAL CONTROL DATA FOR THE RETAINING WALL.

DELETED NOTE AND ILLUSTRATION CONCERNING TEMP SPL SHORING
SHEET 212 - CHANGED HORIZONTAL CONTROL DATA FOR THE RETAINING WALL.
DELETED NOTE AND ILLUSTRATION OF TEMP SPL SHORING
SHEET 213 - CHANGED BEGINNING POINT FOR RETAINING WALL.
CHANGED HORIZONTAL ALIGNMENT DATA FOR RETAINING WALL.
DELETED NOTE AND ILLUSTRATION OF TEMP SPL SHORING.
SHEET 214 - CHANGED HORIZONTAL ALIGNMENT DATA FOR RETAINING WALL.
DELETED NOTE AND ILLUSTRATION OF TEMP SPL SHORING.
SHEET 215 - DELETED NOTE AND ILLUSTRATION OF TEMP SPL SHORING
CHANGED HORIZONTAL ALIGNMENT DATA FOR RETAINING WALL.
SHEET 216 - CHANGED HORIZONTAL ALIGNMENT DATA FOR RETAINING WALL.
DELETED NOTE AND ILLUSTRATION OF TEMP SPL SHORING
SHEET 217 AND 218 - DELETED NOTE AND ILLUSTRATION OF TEMP SPL SHORING
CHANGED HORIZONTAL CONTROL DATA FOR RETAINING WALL
SHEET 219 - DELETED NOTE AND ILLUSTRATION OF TEMP SPL SHORING
SHEET 219JJ - ADDED
SHEET 224A AND 224B - ADDED
SHEET 369A - ADDED
SHEET 421,422,426,431,436 - ADDED NOTE NUMBER 2.
SHEET 439 - ADDED NOTE NUMBER 2 AND MOVED RAILROAD MARKINGS.
SHEET 443 - ADDED NOTE NUMBER
SHEET 444 THRU 447, 450,451 - ADDED NOTE NUMBER 1
SHEET 452 - CHANGED SHEET ESTIMATED QUANTITIES TABLE.
SHEET 453 - ADDED NOTE NUMBER 1
SHEET 454 - CHANGED SHEET ESTIMATED QUANTITIES TABLE.
SHEET 455 THRU 461 - ADDED NOTE NUMBER 1.
SHEET 465,475 - CHANGED TEXT ON SIGNS TO READ "2 MILES"
SHEET 479 - ADDED PAVEMENT MARKING TRANSITION DETAIL.
SHEET 498 - MOVED RAILROAD CROSSING MARKINGS
SHEET 501 THRU 506 - CHANGED SEVERAL ITEMS IN THE SHEET SUMMARY OF
PROPOSED QUANTITIES.
ALTERED POSITION OF SEVERAL SAFETY LIGHTING POLES.
SHEET 507 AND 508 - REVISED TYPE AND PLACEMENT OF SEVERAL ILLUMINATION
DEVICES.
SHEET 508A - ADDED
SHEET 531 - REVISED NOTE INDICATED.
SHEET 538 - REVISED NOTE INDICATED.
SHEET 541 - REVISED NOTE INDICATED.

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	100	2002	001	PREPARING ROW DOLLARS and CENTS	STA	187.500	1
	105	2015		REMOVING STAB BASE & ASPH PAV (8"-10") DOLLARS and CENTS	SY	37,519.000	2
	110	2001		EXCAVATION (ROADWAY) DOLLARS and CENTS	CY	19,160.000	3
	132	2003		EMBANKMENT (FINAL)(ORD COMP)(TY B) DOLLARS and CENTS	CY	3,574.000	4
	161	2005		COMPOST MANUF TOPSOIL (PB) (4") DOLLARS and CENTS	SY	24,344.000	5
	161	2026		COMPOST MANUF TOPSOIL (BOS OR PB) (6") DOLLARS and CENTS	SY	20,036.000	6
	162	2002		BLOCK SODDING DOLLARS and CENTS	SY	44,380.000	7
	168	2001		VEGETATIVE WATERING DOLLARS and CENTS	MG	2,665.540	8
	247	2044		FL BS (CMP IN PLC)(TY A GR 4)(FNAL POS) DOLLARS and CENTS	CY	16,844.000	9
	260	2001	001	LIME (HYDRATED LIME (DRY)) DOLLARS and CENTS	TON	900.000	10
	260	2006	001	LIME TRT (EXST MATL) (6") DOLLARS and CENTS	SY	66,564.000	11

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	340	2106		D-GR HMA(METH) TY-D PG64-22 DOLLARS and CENTS	TON	2,717.000	12
	341	2063		D-GR HMA(QCQA) TY-C SAC-A PG76-22 DOLLARS and CENTS	TON	40,412.000	13
	354	2057		PLANE ASPH CONC PAV (4") DOLLARS and CENTS	SY	338,638.000	14
	360	2001	003	CONC PVMT (CONT REINF-CRCP)(8") DOLLARS and CENTS	SY	3,091.000	15
	360	2003	003	CONC PVMT (CONT REINF-CRCP)(10") DOLLARS and CENTS	SY	69,848.000	16
	361	2001		FULL-DEPTH REPAIR CRCP (8") DOLLARS and CENTS	SY	94.000	17
	361	2003		FULL-DEPTH REPAIR CRCP (10") DOLLARS and CENTS	SY	158.000	18
	400	2003		STRUCT EXCAV (PIPE) DOLLARS and CENTS	CY	10.000	19
	403	2001		TEMPORARY SPL SHORING DOLLARS and CENTS	SF	2,040.000	20
	416	2001	001	DRILL SHAFT (18 IN) DOLLARS and CENTS	LF	143.000	21
	416	2003	001	DRILL SHAFT (30 IN) DOLLARS and CENTS	LF	2,035.000	22

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	ITEM NO	DESC CODE	S.P. NO.				
	416	2005	001	DRILL SHAFT (42 IN) DOLLARS and CENTS	LF	7,407.000	23
	416	2015	001	DRILL SHAFT (NON-REINFORCED)(12 IN) DOLLARS and CENTS	LF	76.000	24
	416	2018	001	DRILL SHAFT (SIGN MTS)(24 IN) DOLLARS and CENTS	LF	53.500	25
	416	2019	001	DRILL SHAFT (SIGN MTS)(30 IN) DOLLARS and CENTS	LF	140.000	26
	416	2020	001	DRILL SHAFT (SIGN MTS)(36 IN) DOLLARS and CENTS	LF	590.000	27
	416	2022	001	DRILL SHAFT (SIGN MTS)(48 IN) DOLLARS and CENTS	LF	40.000	28
	416	2023	001	DRILL SHAFT (SIGN MTS)(54 IN) DOLLARS and CENTS	LF	20.000	29
	416	2032	001	DRILL SHAFT (TRF SIG POLE) (36 IN) DOLLARS and CENTS	LF	104.000	30
	420	2004	003	CL C CONC (BENT) DOLLARS and CENTS	CY	606.600	31
	420	2005	003	CL C CONC (FOOTING) DOLLARS and CENTS	CY	15.500	32
	420	2033	003	CL S CONC (APPR SLAB) DOLLARS and CENTS	CY	240.500	33

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	ITEM NO	DESC CODE	S.P. NO.				
	423	2001		RETAINING WALL (MSE) DOLLARS and CENTS	SF	6,021.000	34
	423	2009		RETAINING WALL (SOIL NAILED)(FACIA) DOLLARS and CENTS	SF	13,472.000	35
	425	2002		PRESTR CONC BEAM (TY B) DOLLARS and CENTS	LF	11,783.610	36
	427	2002		CONCETE PAINT FINISH DOLLARS and CENTS	SF	38,501.000	37
	430	2002		CL C CONC FOR EXT STR (ABUT) DOLLARS and CENTS	CY	92.600	38
	430	2004		CL S CONC FOR EXT STR (SLAB) DOLLARS and CENTS	CY	1,874.800	39
	432	2001		RIPRAP (CONC)(4 IN) DOLLARS and CENTS	CY	194.310	40
	432	2038		RIPRAP (CONC) (CL A) DOLLARS and CENTS	CY	10.700	41
	442	2005	005	STR STL (MISCELLANEOUS) DOLLARS and CENTS	LB	2,351.000	42
	450	2013		RAIL (TY SSTR) DOLLARS and CENTS	LF	6,053.000	43
	450	2039		RAIL (TY SSTR)(MOD) DOLLARS and CENTS	LF	3,382.000	44

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	ITEM NO	DESC CODE	S.P. NO.				
	454	2004		ARMOR JOINT DOLLARS and CENTS	LF	456.000	45
	454	2006		HEADER TYPE EXPANSION JOINT DOLLARS and CENTS	LF	1,468.000	46
	464	2005		RC PIPE (CL III)(24 IN) DOLLARS and CENTS	LF	97.000	47
	465	2013		MANH (COMPL)(TY A) DOLLARS and CENTS	EA	19.000	48
	465	2114		INLET (COMPL)(TY Y) DOLLARS and CENTS	EA	6.000	49
	465	2188		INLET (COMPL)(DROP)(TY Y-1) DOLLARS and CENTS	EA	3.000	50
	471	2003		GRATE & FRAME DOLLARS and CENTS	EA	29.000	51
	479	2006		ADJUST INLET (CAP) DOLLARS and CENTS	EA	4.000	52
	500	2001	002	MOBILIZATION DOLLARS and CENTS	LS	1.000	53
	502	2001	022	BARRICADES, SIGNS AND TRAFFIC HAN- DLING DOLLARS and CENTS	MO	20.000	54

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	506	2027		BLADING WORK (EROSION & SEDM CONT) DOLLARS and CENTS	HR	21.000	55
	506	2034		TEMPORARY SEDIMENT CONTROL FENCE DOLLARS and CENTS	LF	38,218.000	56
	512	2065	001	PCTB(F&I) (SNGL SLP TY2)OR(F-SHAPE TY1) DOLLARS and CENTS	LF	30,150.000	57
	512	2066	001	PCTB(MOVE)(SNGL SLP TY2)OR(F-SHAPE TY1) DOLLARS and CENTS	LF	22,660.000	58
	512	2067	001	PCTB(RMOV)(SNGL SLP TY2)OR(F-SHAPE TY1) DOLLARS and CENTS	LF	30,150.000	59
	514	2005	001	PERM CONC TRF BARR (SGL SLP)(TY 2)(42") DOLLARS and CENTS	LF	10,104.000	60
	514	2006	001	PERM CONC TRF BARR (SGL SLP)(TY 3)(42") DOLLARS and CENTS	LF	896.000	61
	514	2022	001	PERM CONC TRF BARR (SGL SLP)(TY 4)(42") DOLLARS and CENTS	LF	550.000	62
	529	2002		CONC CURB (TY II) DOLLARS and CENTS	LF	2,342.000	63
	530	2010		DRIVEWAYS (CONC) DOLLARS and CENTS	SY	179.000	64

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	ITEM NO	DESC CODE	S.P. NO.				
	531	2005		CURB RAMPS (TY 1) DOLLARS CENTS and	EA	34.000	65
	531	2006		CURB RAMPS (TY 2) DOLLARS CENTS and	EA	54.000	66
	531	2010		CURB RAMPS (TY 7) DOLLARS CENTS and	EA	50.000	67
	531	2014		CURB RAMPS (TY 22) DOLLARS CENTS and	EA	1.000	68
	531	2015		CONC SIDEWLKS (4") DOLLARS CENTS and	SY	19,183.000	69
	531	2017		CURB RAMPS (TY 21) DOLLARS CENTS and	EA	5.000	70
	536	2002		CONC MEDIAN DOLLARS CENTS and	SY	12.000	71
	540	2001		MTL W-BEAM GD FEN (TIM POST) DOLLARS CENTS and	LF	2,187.500	72
	540	2005		TERMINAL ANCHOR SECTION DOLLARS CENTS and	EA	26.000	73
	540	2011		MTL BEAM GD FEN TRANS (THRIE-BEAM) DOLLARS CENTS and	EA	12.000	74
	544	2006		GDRAIL END TRT(INST)(WOOD POST)(TY III) DOLLARS CENTS and	EA	26.000	75

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	545	2001		CRASH CUSH ATTEN (INSTL) DOLLARS and CENTS	EA	20.000	76
	545	2002		CRASH CUSH ATTEN (MOVE & RESET) DOLLARS and CENTS	EA	8.000	77
	545	2003		CRASH CUSH ATTEN (REMOVE) DOLLARS and CENTS	EA	19.000	78
	610	2047		INS RD IL AM (TY SP) 48S-8-8 (.4 KW)S DOLLARS and CENTS	EA	53.000	79
	610	2060		INS RD IL AM (U/P) (TY 1) (.15KW)S DOLLARS and CENTS	EA	14.000	80
	610	2072		REMOVE RDWY ILL ASSEM DOLLARS and CENTS	EA	53.000	81
	610	2074		INS RD IL AM (TY ST) 40T-8-8 (.25 KW)S DOLLARS and CENTS	EA	42.000	82
	617	2003		TEMP RD IL (TIMBER POLES W/ARMS) DOLLARS and CENTS	MO	6.000	83
	618	2018		CONDT (PVC) (SCHD 40) (2") DOLLARS and CENTS	LF	10,136.000	84
	618	2028		CONDT (PVC) (SCHD 80) (1") DOLLARS and CENTS	LF	30.000	85
	618	2029		CONDT (PVC) (SCHD 80) (1") (BORE) DOLLARS and CENTS	LF	170.000	86

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	ITEM NO	DESC CODE	S.P. NO.				
	618	2034		CONDT (PVC) (SCHD 80) (2") DOLLARS and CENTS	LF	13,000.000	87
	618	2035		CONDT (PVC) (SCHD 80) (2") (BORE) DOLLARS and CENTS	LF	883.000	88
	618	2046		CONDT (RM) (1") DOLLARS and CENTS	LF	2,866.000	89
	618	2052		CONDT (RM) (2") DOLLARS and CENTS	LF	405.000	90
	618	2053		CONDT (RM) (2") (BORE) DOLLARS and CENTS	LF	4,845.000	91
	620	2004	001	ELEC CONDR (NO. 2) INSULATED DOLLARS and CENTS	LF	27,523.000	92
	620	2008	001	ELEC CONDR (NO. 4) INSULATED DOLLARS and CENTS	LF	9,400.000	93
	620	2010	001	ELEC CONDR (NO. 6) INSULATED DOLLARS and CENTS	LF	4,570.000	94
	620	2011	001	ELEC CONDR (NO. 8) BARE DOLLARS and CENTS	LF	12,897.000	95
	620	2012	001	ELEC CONDR (NO. 8) INSULATED DOLLARS and CENTS	LF	6,136.000	96
	620	2013	001	ELEC CONDR (NO.10) BARE DOLLARS and CENTS	LF	3,053.000	97

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	ITEM NO	DESC CODE	S.P. NO.				
	624	2008		GROUND BOX TY A (122311) W/APRON DOLLARS and CENTS	EA	60.000	98
	624	2014		GROUND BOX TY D (162922) W/APRON DOLLARS and CENTS	EA	6.000	99
	628	2003		ELC SRV TY A 120/240 060 (NS)SS(E)GC(U) DOLLARS and CENTS	EA	8.000	100
	628	2065		ELC SRV TY D 120/240 060 (NS)GS(N)TP(O) DOLLARS and CENTS	EA	8.000	101
	628	2132		ELC SRV TY D 120/240 150 (NS)GS(N)TP(O) DOLLARS and CENTS	EA	1.000	102
	628	2158		REMOVE ELECTRICAL SERVICES DOLLARS and CENTS	EA	19.000	103
	636	2001		ALUMINUM SIGNS (TY A) DOLLARS and CENTS	SF	426.500	104
	636	2002		ALUMINUM SIGNS (TY G) DOLLARS and CENTS	SF	737.000	105
	636	2003		ALUMINUM SIGNS (TY O) DOLLARS and CENTS	SF	2,467.500	106
	636	2007		REPLACE EXISTING ALUMINUM SIGNS (TY A) DOLLARS and CENTS	SF	294.000	107

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	ITEM NO	DESC CODE	S.P. NO.				
	636	2008		REPLACE EXISTING ALUMINUM SIGNS (TY G) DOLLARS and CENTS	SF	1,030.250	108
	636	2009		REPLACE EXISTING ALUMINUM SIGNS (TY O) DOLLARS and CENTS	SF	3,065.650	109
	644	2022		INS SM RD SN SUP&AM TY S80(1) SA(P) DOLLARS and CENTS	EA	214.000	110
	644	2025		INS SM RD SN SUP&AM TY S80(1) SA(T) DOLLARS and CENTS	EA	95.000	111
	644	2027		INS SM RD SN SUP&AM TY S80(1) SA(U) DOLLARS and CENTS	EA	10.000	112
	644	2035		INS SM RD SN SUP&AM TY S80(1) SB(T) DOLLARS and CENTS	EA	53.000	113
	644	2060		REMOVE SM RD SN SUP & AM DOLLARS and CENTS	EA	404.000	114
	647	2001		INSTALL LRSS (STRUCT STEEL) DOLLARS and CENTS	LB	4,013.000	115
	647	2003		REMOVE LRSA DOLLARS and CENTS	EA	15.000	116
	650	2028		INS OH SN SUP(30 FT CANT) DOLLARS and CENTS	EA	1.000	117

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	650	2068		INS OH SN SUP(65 FT BRDG) DOLLARS and CENTS	EA	2.000	118
	650	2073		INS OH SN SUP(70 FT BRDG) DOLLARS and CENTS	EA	2.000	119
	650	2078		INS OH SN SUP(75 FT BRDG) DOLLARS and CENTS	EA	4.000	120
	650	2083		INS OH SN SUP(80 FT BRDG) DOLLARS and CENTS	EA	1.000	121
	650	2173		REMOVE OVERHD SIGN SUP DOLLARS and CENTS	EA	12.000	122
	652	2002		REMOVE HWY SIGN LIGHT FIXT DOLLARS and CENTS	EA	56.000	123
	658	2263	006	INSTL DEL ASSM (D-SY)SZ 1(FLX)GND DOLLARS and CENTS	EA	33.000	124
	658	2292	006	INSTL DEL ASSM (D-DW)SZ 1(FLX)GND DOLLARS and CENTS	EA	88.000	125
	658	2316	006	INSTL OM ASSM (OM-2Z)(FLX)GND DOLLARS and CENTS	EA	22.000	126
	658	2318	006	INSTL OM ASSM (OM-2Z)(FLX)SRF DOLLARS and CENTS	EA	11.000	127
	658	2329	006	INSTL DEL ASSM (D-SW)SZ 1(FLX)GND DOLLARS and CENTS	EA	151.000	128

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	662	2050		WK ZN PAV MRK REMOV (REFL) TY I-A DOLLARS and CENTS	EA	1,376.000	129
	662	2052		WK ZN PAV MRK REMOV (REFL) TY I-C DOLLARS and CENTS	EA	1,376.000	130
	662	2056		WK ZN PAV MRK REMOV (REFL) TY II-C-R DOLLARS and CENTS	EA	2,750.000	131
	662	2061		WK ZN PAV MRK REMOV (TRAF BTN) TY W DOLLARS and CENTS	LF	55,640.000	132
	662	2063		WK ZN PAV MRK REMOV (TRAF BTN) TY Y DOLLARS and CENTS	LF	55,640.000	133
	662	2113		WK ZN PAV MRK SHT TERM (TAB) TY W DOLLARS and CENTS	EA	11,240.000	134
	662	2114		WK ZN PAV MRK SHT TERM (TAB) TY Y DOLLARS and CENTS	EA	11,240.000	135
	662	2115		WK ZN PAV MRK SHT TERM (TAB) TY Y-2 DOLLARS and CENTS	EA	22,480.000	136
	666	2053		REFL PAV MRK TY I (W) (ARROW) (090MIL) DOLLARS and CENTS	EA	32.000	137
	666	2068		REFL PAV MRK TY I(W)(DBL ARROW)(090MIL) DOLLARS and CENTS	EA	21.000	138

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	666	2083		REFL PAV MRK TY I(W)(RR XING) (090MIL) DOLLARS and CENTS	EA	3.000	139
	666	2095		REFL PAV MRK TY I (W) (WORD) (090MIL) DOLLARS and CENTS	EA	32.000	140
	666	2160		REF PAV MRK TY II (W) (ARROW) DOLLARS and CENTS	EA	32.000	141
	666	2165		REF PAV MRK TY II (W) (DBL ARROW) DOLLARS and CENTS	EA	21.000	142
	666	2169		REF PAV MRK TY II (W) (RR XING) DOLLARS and CENTS	EA	3.000	143
	666	2173		REF PAV MRK TY II (W) (WORD) DOLLARS and CENTS	EA	32.000	144
	672	2010		REFL PAV MRKR TY I-A DOLLARS and CENTS	EA	688.000	145
	672	2012		REFL PAV MRKR TY I-C DOLLARS and CENTS	EA	688.000	146
	672	2014		REFL PAV MRKR TY I-R DOLLARS and CENTS	EA	168.000	147
	672	2015		REFL PAV MRKR TY II-A-A DOLLARS and CENTS	EA	479.000	148
	672	2017		REFL PAV MRKR TY II-C-R DOLLARS and CENTS	EA	4,280.000	149

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	672	2024		TRAFFIC BUTTON TY W DOLLARS and CENTS	EA	4,813.000	150
	672	2025		TRAFFIC BUTTON TY Y DOLLARS and CENTS	EA	2,063.000	151
	677	2001		ELIM EXT PAV MRK & MRKS (4") DOLLARS and CENTS	LF	82,500.000	152
	680	2002		INSTALL HWY TRF SIG (ISOLATED) DOLLARS and CENTS	EA	5.000	153
	682	2001		BACK PLATE (12 IN) (3 SEC) DOLLARS and CENTS	EA	63.000	154
	682	2003		BACK PLATE (12 IN) (5 SEC) DOLLARS and CENTS	EA	8.000	155
	682	2014		PED SIG SEC (12 IN) LED (2 INDICATIONS) DOLLARS and CENTS	EA	68.000	156
	682	2022		VEH SIG SEC (12 IN) LED (GRN ARW) DOLLARS and CENTS	EA	8.000	157
	682	2023		VEH SIG SEC (12 IN) LED (GRN) DOLLARS and CENTS	EA	71.000	158
	682	2024		VEH SIG SEC (12 IN) LED (YEL ARW) DOLLARS and CENTS	EA	8.000	159
	682	2025		VEH SIG SEC (12 IN) LED (YEL) DOLLARS and CENTS	EA	71.000	160

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	682	2027		VEH SIG SEC (12 IN) LED (RED) DOLLARS and CENTS	EA	71.000	161
	686	2005		INS TRF SIG PL AM(S) STR (TY B) DOLLARS and CENTS	EA	8.000	162
	734	2002		LITTER REMOVAL DOLLARS and CENTS	CYC	44.000	163
	738	2001		CLEANING/SWEEPING (CENTER MEDIAN) DOLLARS and CENTS	CYC	22.000	164
	738	2003		CLEANING/SWEEPING (OUTSIDE MAIN LANE) DOLLARS and CENTS	CYC	22.000	165
	738	2005		CLEANING/SWEEPING (FRONTAGE ROAD) DOLLARS and CENTS	CYC	22.000	166
	4116	2001		SOIL NAIL ANCHORS DOLLARS and CENTS	LF	14,697.000	167
	5344	2001		WATER TANK AND PUNP DOLLARS and CENTS	GAL	10.000	168
	5345	2001		MOBILE WATER STORAGE TANK (TY II) DOLLARS and CENTS	EA	1.000	169
	6006	2001		SPREAD SPECTRUM RADIO DOLLARS and CENTS	EA	15.000	170

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	6006	2002		COAXIAL CABLE DOLLARS and CENTS	LF	620.000	171
	6006	2004		ANTENNA (OMNI-DIRECTIONAL) DOLLARS and CENTS	EA	5.000	172
	6006	2005		ANTENNA (UNI-DIRECTIONAL) DOLLARS and CENTS	EA	10.000	173
	6007	2001		REMOVING TRAFFIC SIGNALS DOLLARS and CENTS	EA	5.000	174
	6008	2002		REMOVE OVERHEAD SIGN PANELS DOLLARS and CENTS	EA	3.000	175
	6009	2001		ITS SYSTEM SUPPORT EQUIPMENT DOLLARS and CENTS	LS	1.000	176
	6010	2031		COMM CABLE (22 AWG)(6 PAIR) DOLLARS and CENTS	LF	21,035.000	177
	6038	2001		PORTABLE CHANGEABLE MESSAGE SIGN DOLLARS and CENTS	DAY	574.000	178
	6110	2014		REF PAV MRK TY I (W)(4")(BRK)(90 MIL) DOLLARS and CENTS	LF	31,344.000	179
	6110	2017		REF PAV MRK TY I (W)(4")(SLD)(90 MIL) DOLLARS and CENTS	LF	37,469.000	180
	6110	2020		REF PAV MRK TY I (W)(4")(DOT)(90 MIL) DOLLARS and CENTS	LF	778.000	181

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	6110	2035		REF PAV MRK TY I (W)(8")(SLD)(90 MIL) DOLLARS and CENTS	LF	16,516.000	182
	6110	2041		REF PAV MRK TY I (W)(12")(SLD)(90 MIL) DOLLARS and CENTS	LF	739.000	183
	6110	2050		REF PAV MRK TY I (W)(24")(SLD)(90 MIL) DOLLARS and CENTS	LF	5,118.000	184
	6110	2056		REF PAV MRK TY I (Y)(4")(SLD)(90 MIL) DOLLARS and CENTS	LF	66,783.000	185
	6110	2071		REF PAV MRK TY I (Y)(8")(SLD)(90 MIL) DOLLARS and CENTS	LF	6,888.000	186
	6110	2077		REF PAV MRK TY I (Y)(24")(SLD)(90 MIL) DOLLARS and CENTS	LF	1,277.000	187
	6110	2082		REF PAV MRK TY II (W)(4")(BRK) DOLLARS and CENTS	LF	31,344.000	188
	6110	2083		REF PAV MRK TY II (W)(4")(DOT) DOLLARS and CENTS	LF	778.000	189
	6110	2084		REF PAV MRK TY II (W)(4")(SLD) DOLLARS and CENTS	LF	37,469.000	190
	6110	2092		REF PAV MRK TY II (W)(8") (SLD) DOLLARS and CENTS	LF	16,516.000	191
	6110	2094		REF PAV MRK TY II (W)(12") (SLD) DOLLARS and CENTS	LF	739.000	192

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	6110	2096		REF PAV MRK TY II (W)(24") (SLD) DOLLARS and CENTS	LF	5,118.000	193
	6110	2098		REF PAV MRK TY II (Y)(4") (SLD) DOLLARS and CENTS	LF	66,783.000	194
	6110	2106		REF PAV MRK TY II (Y)(8") (SLD) DOLLARS and CENTS	LF	6,888.000	195
	6110	2107		REF PAV MRK TY II (Y)(24") (SLD) DOLLARS and CENTS	LF	1,277.000	196
	6266	2001		VIVDS PROCESSOR SYSTEM DOLLARS and CENTS	EA	5.000	197
	6266	2002		VIVDS CAMERA ASSEMBLY DOLLARS and CENTS	EA	54.000	198
	6266	2003		VIVDS SET-UP SYSTEM DOLLARS and CENTS	EA	5.000	199
	6266	2004		VIVDS CENTRAL CONTROL DOLLARS and CENTS	EA	1.000	200
	6266	2005		VIVDS COMMUNICATION CABLE (COAXIAL) DOLLARS and CENTS	LF	16,973.000	201
	6423	2001		CCTV EQUIPMENT CABINET DOLLARS and CENTS	EA	2.000	202
	6424	2001		CAMERA POLE STRUCTURE DOLLARS and CENTS	EA	2.000	203

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	6426	2001		FINAL ACCEPTANCE PLAN DOLLARS and CENTS	LS	1.000	204
	6427	2001		MULT-DUCT COND SYS (4")4-WAY(CONC ENC) DOLLARS and CENTS	LF	12,775.000	205
	6427	2002		MULT-DUCT COND SYS (4")2-WAY(BORE TMS) DOLLARS and CENTS	LF	110.000	206
	6427	2003		MULT-DUCT COND SYS (4")2-WAY(CONC ENC) DOLLARS and CENTS	LF	255.000	207
	6427	2004		MULT-DUCT COND SYS (4")4-WAY(BORE TMS) DOLLARS and CENTS	LF	2,300.000	208
	6428	2001		RADAR VEH SENSING DEVICE (RVSD) TMS DOLLARS and CENTS	EA	12.000	209
	6429	2001		RELOCATE EXIST FIB OPT DMS SYS (TY-2) DOLLARS and CENTS	EA	1.000	210
	6429	2002		RELOCATE EXIST FIB OPT DMS SYS (TY-3) DOLLARS and CENTS	EA	4.000	211
	6429	2003		RELOCATE EXIST FIB HUB DOLLARS and CENTS	EA	2.000	212

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	6429	2004		RELOCATE EXIST LCS SYSTEM DOLLARS and CENTS	EA	6.000	213
	6429	2005		REMOVE EXIST CCTV FIELD EQUIP DOLLARS and CENTS	EA	2.000	214
	6429	2006		REMOVE EXIST COMM CABINET DOLLARS and CENTS	EA	5.000	215
	6429	2007		REMOVE EXIST FIB OPT DMS SYS (TY-2) DOLLARS and CENTS	EA	1.000	216
	6429	2008		REMOVE EXIST FIB OPT DMS SYS (TY-3) DOLLARS and CENTS	EA	4.000	217
	6429	2009		REMOVE EXIST FIB HUB DOLLARS and CENTS	EA	2.000	218
	6429	2010		REMOVE EXIST LCS SYS DOLLARS and CENTS	EA	6.000	219
	6429	2011		DMS CABINET FOUNDATION DOLLARS and CENTS	EA	5.000	220
	6429	2012		FIB HUB FOUNDATION DOLLARS and CENTS	EA	2.000	221
	6429	2013		LCS CABINET FOUNDATION DOLLARS and CENTS	EA	5.000	222
	6429	2014		REMOVE EXIST VIVDS DOLLARS and CENTS	EA	2.000	223

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	6430	2001		FIB OPT CBL (SGL MD)(TY-D)(12 STR)TMS DOLLARS and CENTS	EA	22,950.000	224
	6430	2002		FIB OPT CBL (SGL MD)(TY-E)(6 STR)TMS DOLLARS and CENTS	EA	1,900.000	225
	6430	2003		REMOVE EXIST FIBER OPT CBL (12 STR) DOLLARS and CENTS	LF	25,830.000	226
	6431	2001		DUAL OC-3 ATM MPEG-2 ENCODER DOLLARS and CENTS	EA	2.000	227
	6439	2001		PREP OF EXIST CONDUIT DOLLARS and CENTS	LF	8,265.000	228
	6440	2001		DUAL OC3 ATM MPEG2 DECODER DOLLARS and CENTS	EA	2.000	229
	6441	2001		CCTV FIELD EQUIPMENT DOLLARS and CENTS	EA	2.000	230
	6446	2001		SINGLE MODE FIB OPT VIDEO/DATA TRANS DOLLARS and CENTS	EA	2.000	231
	6447	2001		WIRELESS RADIO CCTV DECODER SITE DOLLARS and CENTS	EA	1.000	232
	6447	2002		WIRELESS RADIO CCTV RECIEVER SITE DOLLARS and CENTS	EA	1.000	233
	6447	2003		WIRELESS RADIO CCTV REP/TRANS SITE DOLLARS and CENTS	EA	1.000	234

PROJECT BR 2006(590) , ETC.
COUNTY BEXAR

PROPOSAL SHEET
TxDOT
FORM 234-B I-61-5M

ALT	ITEM-CODE			UNIT BID PRICE ONLY. WRITTEN IN WORDS	UNIT	APPROX QUANTITIES	DEPT USE ONLY
	ITEM NO	DESC CODE	S.P. NO.				
	6447	2004		WIRELESS RADIO CCTV REPEATER SITE DOLLARS and CENTS	EA	3.000	235
	6447	2005		WIRELESS RADIO CCTV TRANSMITTER SITE DOLLARS and CENTS	EA	1.000	236

Project Number:

Sheet A

County: Bexar

Control: 0017-09-072, Etc.

Highway: IH 35

GENERAL NOTES:

Grading Requirements For:
Item 247 Flex Base (TY A GR 4)

Soil
Constants

Wet
Ball

LL	PI	PI	Mill						
1 3/4"	1 1/4"	7/8"	3/8"	#4	#40	Max	Max	Min	Max

Percent retained on each sieve

(247)	0-10	-	-	-	45-75	68-85	45	15	-	*55
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* The maximum increase in material passing the no. 40 sieve shall not exceed 20.

===== **Compaction Requirements** =====

Item	Material	Course	Density
247	Flex Base	All	95 % Minimum

===== **Basis of Estimate** =====

Item	Description	Rate/Area	Quant-Unit
168	Veg. Watering (SOD)	60 Gal/SY / 44,380 Area	2,663 MG
260	Lime Trt (New Base) (6")	27LBS/SY	66,564 SY
734	Liter Removal	2 Cyc/Mo	44 CYC
738	Cleaning/Sweeping(Center Median)	12 Cyc/Yr	22 CYC
738	Cleaning/Sweeping(Outside ML)	12 Cyc/Yr	22 CYC
738	Cleaning/Sweeping(Frontage Rd)	12 Cyc/Yr	22 CYC

- The Following Is For Information Only - Non Pay-

210	ROLL (FLAT WHEEL) (ITEM 247)	1 HR/200 CY
210	ROLL (TAMPING) (ITEM 132) (ITEM 247)	1 HR/200 CY 1 HR/400 TON
210	ROLL (HEAVY TAMP) (ITEM 132) (ITEM 247)	1 HR/200 CY 1 HR/400 TON
210	ROLL (LT PNEU TIRE) (ITEM 132) (ITEM 247)	1 HR/500 CY 1 HR/200 TON

Project Number:

Sheet B

County: Bexar

Control: 0017-09-072, Etc.

Highway: IH 35

===== **Asphalt Concrete Pavement** =====

Type	Location	Depth	Rate/Area	Quant-Tons
C (SAC-A)	Mainlanes, Shoulders, Frtg. Roads, Ramps	2"	220 LBS/SY / 367,382 Area	40,412
C (SAC-C)	Mainlanes, Shoulders, Frtg. Roads, Ramps,	1"	110 LBS/SY / 49,399 Area	2,717

The following State, District, Local and/or Utility Standards have been modified: ITBS (MOD), SSTR (MOD).

All pavement markings shall be in accordance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

Call the Texas One Call System at 1-800-245-4545 to locate utilities prior to construction.

Utility lines with Asbestos

Existing natural gas steel wrapped and/or asbestos cement (AC) water lines that will no longer be in service are usually abandoned in place (AIP). However, if any of these lines have to be removed for whatever reason (in the way of other construction, to make tie-ins, etc.) removal shall comply with all federal, state and local laws, ordinances and regulations regarding the management of asbestos containing materials. At a minimum, the following procedure shall be followed:

1. Contact the Engineer.
2. Remove only the amount of pipe that's needed to perform the proposed work with removal being at the nearest joint.
3. Cover and secure the ends of the pipe with a double layer of 6 mil plastic. If the pipe is damaged, the entire pipe shall be covered with plastic.
4. Move the pipe to an Engineer's approved secured temporary storage site within the project limits.
5. The Engineer will determine the owner (utility company) of the pipe to coordinate removal from the project. The Contractor will load the pipe onto the removal vehicles but will NOT be responsible for removing the pipe from the project.
6. Removal of the utility pipe from the trench will be subsidiary to the work that created the need for the removal) excavation for structures, roadway excavation, a new line, tie-ins of new to existing lines, etc.). The work performed in handling the pipe after it has been removed from the

trench (covering with plastic, hauling to the temporary site on the project and later loading on the vehicles provided by the utility company or the state) will be paid for through the Force Account procedure.

Contact the Engineer or the City of San Antonio at 210-615-5975(TxDOT) or 210-207-7765 (City) when construction operations are within 400 feet of a signalized intersection to determine/verify the location of loop detectors, conduit, ground-boxes, etc. Any signal equipment damaged by the construction operations shall be repaired or replaced. The method of repair or replacement shall be pre-approved and inspected by the Engineer. Depending on the type and extent of the damage, the Engineer reserves the right to perform the repair or replacement work and the Contractor will be billed for the cost of this work.

All existing raised pavement markings shall be removed as the work progresses as approved by the Engineer. This work will not be paid for separately, but shall be considered subsidiary to the various bid items. Materials removed shall become the property of the Contractor for proper disposal.

In instances where fixed features require, the cross section slopes may be varied to the extent determined/approved by the Engineer.

If waste areas or material source areas result from this project, the Contractor is reminded to follow the requirements of the Texas Aggregate Quarry and Pit Safety Act.

Any materials removed and not reused on the project and determined to be salvageable by the Engineer, shall be retained by the State and shall be stored within the project limits at an approved secure location or delivered undamaged to the salvage/storage yard as directed by the Engineer. Materials that are not determined to be salvageable shall become the property of the Contractor for proper management in accordance with local, state and/or federal requirements at their expense. Traffic signs must be defaced so that they will not reappear in public as signs.

In preparing holes for posts and/or foundations, care shall be taken to not rupture existing drainage structures, electrical conduits, public utilities, etc.

Any sign panels that are to be adjusted and/or removed and replaced, shall be done in the same workday unless otherwise approved by the Engineer.

Sign types for which details are not shown in the plans shall conform to the "Texas MUTCD".

Notify the Engineer and/or the City of San Antonio Traffic Signal Design Engineer (210-733-4573) at least two weeks prior to a proposed traffic pattern change(s) that will require a revision to traffic signals. This is required to provide the State/City time to determine the new signal timing and phasing settings that need to be implemented with the traffic change.

The contractor is directed to the fact that there is a mural painting located on the rewrap on the southwest corner of the IH 35 and Zarzamora street bridge. Do not disturb this area in order to preserve the integrity of the mural.

TMS GENERAL NOTES

“TMS” is abbreviation for Traffic Management System.

Coordinate the installation of TMS equipment, conduit, manholes, ground boxes, etc. with the roadway construction phasing so as to prohibit any open cuts across new construction.

All references to the TRANSGUIDE mainframe are references to the TRANSGUIDE computer network.

Provide a submittal compliance matrix with all TMS submittals.

Perform all TMS Prototype approval, Design approval, and Demonstration tests within the State of Texas.

Not previously used TMS equipment:

Test any TMS Equipment (including but not limited to CCTV field equipment, Fiber Optic Dynamic Message Sign System, Lane Control System), which has not previously been proven to be fully operational and fully compatible with the existing TRANSGUIDE software and hardware in the following manner:

Conduct tests for each type of TMS equipment, as directed by the Engineer, to determine compatibility of the equipment with the existing TRANSGUIDE software and hardware. Prior to field installation, test one complete unit with all components to ensure that it is fully compatible with the existing TRANSGUIDE system. Mount the equipment to a trailer and connect in the field to an existing Fiber Hub. Make all hardware connections and configuration (in the operations center and in the field) and provide all incidentals (cable, connectors, etc.) to make the unit operational. Test all aspects of the system to show full functionality of the equipment and to show full compatibility with the TRANSGUIDE software and hardware. Failure to perform to the requirements of any test will be considered as a defect, and the equipment will be subject to rejection by the Engineer. Rejected equipment may be offered again for retest provided all noncompliance's have been corrected and retested by the Contractor and evidence thereof submitted to the Engineer. Testing is considered subsidiary to the particular bid item, with no direct payment made.

Partial Payments:

The contractor will receive partial payments for the following TMS items unless otherwise approved by the Engineer:

Project Number:

Sheet E

County: Bexar

Control: 0017-09-072, Etc.

Highway: IH 35

Radar Vehicle Sensing Device, Dual OC-3 ATM MPEG2 Encoder, Dual OC-3 ATM MPEG2 Decoder, CCTV Field Equipment, Wireless Radio CCTV, and Single Mode Fiber Optic Video/Data Transceiver.

Partial Payments Consist Of The Following:

Materials On Hand: the Contractor's paid amount is based on the invoices for the material received and stored in his/her yard.

Field Installation: When the Contractor has completed the support structure, (mounted the Dynamic Message sign, and/or CCTV camera) and installs the controller, the department will pay 80% of the bid item.

Stand-Alone Test: when the equipment has passed the stand-alone test, the department will pay 95% of the bid item.

When the TMS equipment has passed the test portion of the final acceptance test, the Department will pay 100% of the bid item.

The above percentages do not include the deduction for standard Retainage.

Submittals:

Include in all TMS submittals the respective bid item (specification number and descriptive code). Indicate compliance on a paragraph by paragraph basis. Ensure that the statements claiming compliance reference the appropriate documentation and the referenced documentation supporting this claim is included with the submittal. Provide referenced documentation that contains the same numbering system as referenced in the submittal. For example, submittal item 6478-501, Section 2.3, Paragraph 3, Meets Requirements (See Attachment "B"). The supporting documentation for Item 6478-501, Section 2.3, Paragraph 3, would be titled as Attachment "B". Provide submittals with the same numbering system as stated in the specification. Failure to submit accordingly will result in rejection by the Engineer.

A TMS submittal will be considered as incomplete and therefore rejected, if it contains items listed as "being furnished by others". It is the responsibility of the Contractor to make sure the submittal addresses all items of the specification.

Provide the following TMS submittals (to be received by the department) within the designated time. The time frame is in calendar days.

Item Description	Submitted By Contractor W/I Days After Authorization To Begin Work	Returned By State W/I Days
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Equipment & Interconnect Wiring Schematic	30	30
Fiber Optic Cable (Single Mode)	30	30
CCTV Field Equipment	30	30
Dual OC-3 ATM MPEG2 Encoder	30	30
Dual OC-3 ATM MPEG2 Decoder	30	30
Single Mode Fiber Optic Video/Data Transceiver Equipment	30	30
Multi-Duct Conduit System	90	15
Wireless Radio CCTV	30	30
Final Acceptance Plan	90	30

Submit those items designated with the (*), if any, together as a Package.

Submit the Final Acceptance Plan in electronic form.

The Contractor may submit items sooner if needed for construction, but no later than the dates stated above.

Provide, to the Engineer, as-built plans in MicroStation format (.dgn files) of the TMS portion of this project when the project is complete. TxDOT will provide the .dgn files of the TMS plan sheets. Update these files with all TMS items as ACTUALLY CONSTRUCTED in the field. Cost to provide as-built plans as described above is subsidiary to the various bid items with no direct payment.

Videotape all TMS equipment which requires training on VHS (1/2") tapes and provide the tapes to the Department for later use. Customize all training specifically for the TRANSGUIDE system; generic training will not be accepted on this project. All tapes become the property of the Department. Materials and labor are subsidiary to the various Bid Items with no direct payment.

TMS equipment and conduit locations are approximate; the precise location is to be determined in the field, therefore the Contractor should not scale equipment off of plan sheets. Plan sheets are to be used for visual location (vicinity). Equipment locations may have to be adjusted due to conflicts with utilities or other structures, as approved by the Engineer. Do not obstruct the natural flow of water with Traffic Management equipment. In low water areas, place Traffic Management equipment on high side of ditch.

Replace or repair any existing to remain Traffic Management Equipment, conduit, cables, etc. damaged during construction, subsidiary to the various bid items with no direct payment. Replace all pavement, sidewalk, curb, rip-rap or any item damaged during construction, subsidiary to the various bid items with no direct payment.

Stencil structure numbers on all new TMS structures for permanent identification as directed by the Engineer.

Ensure that all TMS equipment furnished and installed is completely compatible with the existing hardware and software located within the TRANSGUIDE operations center (i.e. TRANSGUIDE central software). TRANSGUIDE is unique and complicated. The Contractor should contact the Traffic Management Engineer for details on the system network architecture.

Security against theft and vandalism of all Traffic Management equipment is the full responsibility of the Contractor until the date of final acceptance of the project by the Engineer.

Maintenance of all Traffic Management equipment furnished and installed on this project is the full responsibility of the Contractor until date of final acceptance of this project by the Engineer. All required documentation must be turned in before TxDOT will accept project for maintenance.

Submit a layout of equipment and interconnect wiring schematic for the TRANSGUIDE Control Center and Fiber Hubs for approval by the Engineer prior to ordering materials. Consider all interconnect wiring within the TRANSGUIDE Control Center and all interconnect wiring for all equipment in the plans and described within the specifications as subsidiary to the various Bid Items with no direct payment.

Consider the adjusting and/or removal of sign panels on OSB structures to mount TMS Dynamic Message Signs as subsidiary to the various Bid Items with no direct payment, as directed by the Engineer.

Perform all TMS electrical work and provide all TMS electrical materials in accordance with the National Electrical Code.

The location of utilities (including TMS), either underground or overhead, if shown within the right of way are approximate and must be verified by the Contractor before beginning construction operations. TRANSGUIDE will provide the approximate location of TMS equipment, however, it is the responsibility of the Contractor to determine the depth of the Traffic Management conduit.

In accordance with the Underground Facility Damage Prevention Act (One Call Bill) the phone number for a utility locator is 1-800-545-6005. It is the Contractor's responsibility to make arrangements for utility locators as needed.

TxDOT (Traffic Management)	(210)731-5131
TxDOT (Sign Lighting)	(210)615-5995
TxDOT (Traffic Signal)	(210)615-5975

In preparing holes for TMS posts and/or foundations, use care so as not to rupture existing drainage structures, sprinkler systems, electrical conduits and public utilities.

Place small signs on ramps and frontage roads at a lateral clearance of 8 feet to 12 feet from the edge of pavement or as directed by the Engineer.

When installing TMS cabinet foundations where rip-rap presently exists, use care in breaking out existing rip-rap. Do not break out area greater than is required for placement of the foundations. Replace broken out rip-rap with class "B" concrete to the exact slope, pattern and thickness of the existing rip-rap in accordance with item 432, subsidiary to the various bid items with no direct payment.

Work on TMS equipment that integrates into the operational system only between the hours of 12:00 am (midnight) and 4:00 am when the work requires an interface with the TRANSGUIDE operational system. Notify the TransGuide operations manager (731-5242) 48 hrs prior to this work. The contractor is responsible for all cross connects in the TRANSGUIDE computer room and Fiber Hubs.

Notify the TransGuide operations manager (731-5242) one week in advance of any new fiber to existing fiber splicing operations, and of any fiber optic cable cuts as shown in plans.

Traffic Signal Modems:

Reconnect modems in Traffic Signal controllers to new communication cable at intersections as shown on plans. Connect all field wiring and make traffic signal controllers fully operational with the TransGuide system, subsidiary to the various bid items with no direct payment.

--Item 5--

Reference all existing striping and pavement markings in a manner which will allow these markings to be re-established. Extra referencing shall be placed (if needed) to ensure that the Project's markings (lane lines, edge lines, ramp gores, etc.) are in line with signs, TMS arrows, etc. located on overhead sign supports.

ACP placed at curb inlets, traffic inlets and slotted drains shall be neatly tapered to the inlet depression.

If a bridge deck is milled, seal coated and/or overlaid, it shall be cleaned of excess material. This material shall be removed and not just broomed to the sides of the bridge, or under the guardrail approach, etc.

Cover or protect all sealed expansion joints and rails on bridges and all railroad tracks encountered as approved by the Engineer. Clean all of these features if they weren't properly protected.

The above work will not be paid for directly, but will be considered subsidiary work.

Prior to contract letting, bidders may obtain a free computer diskette or a computerized transfer of files (from the Engineer's office) that contains the earthwork information. If copies of the actual cross-sections in addition to, or instead of, the diskette are requested, they will be available at the Engineer's office for borrowing by copying companies for the purpose of making copies for the bidder at the bidder's expense.

When working near aerial electrical lines and/or utility poles, provide adequate safety measures as needed to comply with Federal, State and local regulations. For electrical lines and poles shown in the plans, if the lines need to be de-energized and/or if poles need to be braced, contact the electrical company to coordinate the de-energizing and bracing. Work pertaining to de-energizing lines, bracing poles and any other protective measures will not be paid for at the expense of TxDOT.

Prevention of Migratory Bird Nesting

It is anticipated that migratory birds, a protected group of species, may try to nest on any bridge or culvert, in any vegetation, or gravel substrate, at any time of the year. The preferred nesting season for migratory birds is from February 15 through October 1 of any year. When practicable, measures to avoid migratory bird species, including ROW clearing activities, should be executed outside of the preferred nesting season. Otherwise, nests containing migratory birds must be avoided and work performed elsewhere within the project limits, until the young birds have fledged.

Structures

Bridge and culvert construction operations can not begin until swallow nesting prevention is implemented, until after October 1 if the Engineer determines that swallow nesting is actively occurring, or until the Engineer determines swallow nests have been abandoned. If the State has installed nesting deterrent on the bridges and culverts prior to approval of the contract, maintain the existing nesting deterrent in order to prevent swallow nesting until October 1 or completion of the bridge and culvert work, whichever occurs earlier. If new nests are built and occupied after the beginning of the bridge and culvert work, do not perform work that can interfere with or discourage swallows from returning to their nests. Prevention of swallow nesting can be performed by one of the following methods:

1. By February 15 of any year, begin the removal of any existing completed mud nests and all other mud placed by swallows for the construction of nests on any portion of the bridge and culverts. The Engineer will inspect the bridges and culverts for nest building activity. If swallows begin nest building, scrape or wash down all nest sites on the structure. Perform these activities daily unless the Engineer determines the need to do this work more frequently.

Remove nests and mud through October 1 of any year or until bridge and culvert construction operations are completed.

2. By February 15 of any year, place a nesting deterrent (which prevents access to any portion of the bridge and culvert by swallows) on the entire bridge (except deck and railing) and on culverts.

No extension of contract time or payment of compensation will be granted for a delay or suspension of work caused by nesting swallows. This work is considered subsidiary to the various bid items.

--Item 7—

The total disturbed area for this project is 7.45 Acres. The disturbed area in the project, all project locations in the Contract and Contractor project specific locations (PSL's), within 1 mile of the project limits, for the Contract will further establish the authorization requirements for storm water discharges. The department will obtain an authorization to discharge storm water from the Texas Commission on Environmental Quality (TCEQ) for the construction activities shown on the plans. Obtain any required authorization from the TCEQ for any PSL's for construction support activities on or off the ROW. When the total area disturbed in the Contract and PSL's within 1 mile of the project limits exceeds 5 acres, provide a copy of the Contractor NOI for PSL's on the ROW to the Engineer (to the appropriate MS4 operator when the project is on an off-state system route).

--Item 8--

Working days will be computed and charged in accordance with Article 8.3.A.1: Five-Day Workweek.

Nighttime work will be required, and is defined in Article 8.3.C.: Nighttime Work. Night and/or weekend work is required. Nighttime work will not be allowed during the designated "floating" non-work days unless written permission is obtained from the Engineer. If Nighttime work is performed on a "floating" non-work day requiring an Inspector to be present a working day will be charged.

Primavera Project Planner computer software is required for the progress schedule.

Night and/or weekend work is required. See the Sequence of Work, Traffic Control Plan, time restrictions for lane closures, etc.

The number of working days allowed to complete this project and interim milestones, if any, was calculated using a conceptual time determination schedule that assumes generic resources, production rates and sequences of construction. The time determination schedule also assumes average weather conditions based on historic data for the San Antonio District. The Engineer

will supply bidders upon written request one electronic copy of the time determination schedule compatible with Primavera Project Planner software.

The determination schedule is provided for informational use only and is not intended for bidding or construction purposes. If the bidder utilizes the schedule for bidding or construction purposes, the bidder accepts the schedule and assumes the responsibility for verifying all aspects of the schedule. The department will not adjust the number of working days for the project and milestones, if any, due to differences in opinion regarding any assumptions made in the preparation of the schedule or for errors, omissions or discrepancies found in the time determination schedule.

Locate all manholes and valves within the construction area. Each manhole and valve shall be identified by its owner (SAWS, CPS, etc.) and referenced with station and offset. No roadwork may begin until this list has been submitted to the Engineer. Gas valves shall be accessible at all times, therefore; temp. CTB may not be placed over these valves.

If the Traffic Control Plan/Sequence of Work requires traffic to be moved to a new pavement section prior to the placement of the final mat of ACP, construct all manholes and/or valves to final pavement elevations just prior to the final mat of ACP. If, between the final elevation adjustment and the final mat of ACP, the manholes and/or valves are going to be exposed to traffic, place temporary asphalt around the manhole and/or valve to provide a +/- 50:1 taper. The cost of elevation adjustment and asphalt tapers will not be paid for directly, but will be part of the price bid for other manhole and/or valve work.

--Item 9--

When directed/approved by the Engineer, provide two uniformed, off-duty law enforcement officers with two officially marked vehicles (if patrol cruisers are available from the enforcement agency) during work that requires a lane to be closed. These officers in patrol cruisers (if provided) shall be located as directed/approved by the Engineer to monitor and/or direct traffic during the lane closure. The method used to direct traffic at signalized intersections shall be as directed/approved by the Engineer. Additional officers and cruisers may be required when directed/approved by the Engineer.

--Item 100--

Do not begin any clearing operations until the trees and areas of vegetation that should not be removed or disturbed by construction activities have been established. To ensure that these areas are not disturbed, place protection fencing as shown in the plans or as directed/approved by the Engineer.

All right of way clearing operations will be coordinated with the SW3P and as directed/approved by the Engineer.

Trim and remove brush and trees to construct the project or to provide a horizontal clearance of approximately 2 feet inside the right of way line and a vertical clearance of at least 12 feet. No vertical flailing equipment will be allowed and the method used shall be approved by the Engineer.

To avoid the spread of oak wilt disease, all species of oak trees that are damaged or cut (branches, roots and/or stumps), treat with a commercial tree wound dressing (pruning spray). To prevent possible infection from tree to tree, disinfect all pruning tools with a solution of 70% isopropyl alcohol before moving to the next tree. Unless otherwise approved by the Engineer, tree limbs and trees shall be removed from the project no later than the next working day in which they were removed. The Engineer can stop all construction operations if the above dressing and/or cut requirements are not followed.

--Item 160--

All areas that receive topsoil shall be sodded or seeded, fertilized and watered in accordance with the appropriate bid items and/or as directed/approved by the Engineer.

--Item 161--

Existing topsoil for CMT may be windrowed or stockpiled (as approved/directed by the Engineer) for later use as Compost Manufactured Topsoil (CMT). Erosion control measures for the stockpile and/or windrow shall be placed as directed/approved by the Engineer.

All areas that receive CMT shall be seeded or sodded, fertilized and watered in accordance with the appropriate bid items, and/or as directed/approved by the Engineer.

--Item 162--

Use of an organic or non-asphaltic biodegradable material that is manufactured as a tacking agent for straw and/or hay mulch applications is required. Use of an asphaltic material as the tacking agent shall be approved by the Engineer, and if used, shall be MS-2.

Furnish and place 44,380 SY of grass sod.

--Item 168--

Watering rates for sod: 3 gals./S.Y./cycle with 3 cycles per week for the first 4 weeks then 1 cycle per week for the next 8 weeks. Increasing the gals./S.Y. cycle to decrease the number of cycles/week is not allowed.

These rates are to estimate the amount of watering that might be needed to supplement natural rainfall to keep the soil moist until germination and establishment of seeds and grasses can occur. Adjust these rates as directed/or approved by the Engineer to take into account actual field conditions such as rain, soil temperature, soil texture, air temperature, sunny vs. cloudy days, etc. Increasing the gals./S.Y. cycle to decrease the number of cycles/week is not allowed.

--Item 260--

Lime trucks at the project may be randomly selected and required to be re-weighed at public scales. If the weight of the lime varies by more than 2%, payment will be as determined by these public scales.

--Item 300--

The asphalt binder used in the manufacture of the non-surface layers of the hot mix asphaltic concrete, shall be PG 64-22.

The asphalt binder used in the manufacture of the hot mix asphaltic concrete surface mat shall be PG 76-22.

--Item 320--

320-1 All longitudinal ACP joints adjacent to a travel lane shall be constructed with a joint marker device which will create a 3:1 to 6:1 taper. For placement of 2 inches or more, the device shall provide a maximum ½ inch vertical edge. Outside edges (next to the grass) shall also have a taper or shall be backfilled the same day.

The ACP operation shall provide a material transfer device capable of transferring mix from the haul truck to the paver. If a material transfer vehicle is used, monitor the loading to not damage the existing pavement structure. Material transfer devices can include a pick up machine, such as a Lincoln 660 or similar.

--Item 341--

See Item 585 for ride quality information.

341-2 R.A.P. (Department or Contractor owned) is allowed for ACP, but not for the surface mat.

The longitudinal joints in the top lift (surface mat) shall be at the lane lines or as directed by the Engineer.

The asphalt plant shall be equipped with truck scales as defined in Item 520. Three weight tickets bearing the date, the truck number, the gross, net & tare weights shall be given to the truck driver then given to the State inspector at the spreading and finishing machine. Trucks may be required to weigh on public scales or portable platform scales to verify the weight of the ticket.

The minimum Surface Aggregate Classification required shall be class "C".

The requirements for the travel-lanes shall also apply for the shoulders.

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Table 8, of the Hamburg Wheel Test Requirements is changed for PG 64 or lower. Minimum number of passes at 0.5" Rut Dept, Tested at 122 degrees F shall be 5,000.

Submit a copy of the Tex 233-F production charts to the Engineer on a weekly basis. At the end of the ACP work, all originals shall be provided to the Engineer.

Crushing of the aggregate for hot mix and immediate use for production of the mix is not allowed. The aggregate shall be stockpiled until enough material is available for five days of production unless prior approval is provided by the Engineer. In order to provide adequate time for design and verification of the mix, a pre-placement meeting shall be held at least one month prior to the placement of the hot mix.

The main purpose of hot mix cores taken by the State are for payment calculations. If (for quality control purposes) the Contractor wants core information sooner, take additional cores.

The use of diesel and/or solvents as asphalt release agents in production, transportation, and/or construction is not allowed. The list of approved asphalt release agents may be obtained from the District Laboratory.

No more than one hot mix lot will be open for any specific type of hot mix, unless authorized by the Engineer. After a lot is open and the Contractor gets the Engineer's approval to change plants or producers, the previous lot will be closed and a new lot will be opened. The numbering for the lots produced at the new plant/producer will start with lot 1. If allowed by the Engineer to switch back to the original or previous plant or producer, the next lot from that plant or producer will resume numbering sequentially from the last lot produced by that plant or producer.

Schedule lay-down operational production/placement where uneven travel lanes are minimized and eliminated weekly.

--Item 354--

Retain planed material.

Take precaution to avoid damage to existing bridge decks and armor joints. Any damage to the bridge decks and/or armor joints shall be repaired as approved/directed by the Engineer.

--Item 420--

Mass concrete will be measured in place.

Bent concrete is a plan quantity structure element.

--Item 421 & 520--

After the concrete producer contacts the District Laboratory or the Engineer's office (when outside the San Antonio area) to request an inspector at the batch plant, if an inspector is not available, TxDOT will notify the producer. At that time, if the producer has a TxDOT approved automated batch ticket and the concrete is not for bridge drill shafts, columns, caps, abutments, decks and/or top slab of a direct traffic culvert, the producer will be allowed to batch without a TxDOT inspector being present.

The concrete producer is required to use an automated ticket that contains the same information as TxDOT's ticket. The producer's ticket shall be a computer printout submitted to TxDOT for approval prior to use. Concrete for bridge drill shafts, columns, caps, abutments, decks and/or top slabs of direct traffic culverts shall be batched in the presence of a TxDOT inspector using the producer's concrete batch ticket.

Finish all TMS concrete structures with a Grade I Class B, Type I finish or as approved by the engineer.

--Item 423--

The backfill material for pre cast retaining walls shall be approved by the Engineer before placement unless otherwise directed/approved by the Engineer. Large stockpile(s) shall be built in lifts not to exceed 2 feet and a minimum working face of not less than 10 feet and a not more than 20 feet.

--Item 427--

The surface area of finish applied to the existing concrete where required shall be the same as applied to the adjoining new concrete surface or as directed/approved by the Engineer. A concrete paint finish shall be used to cover Surface Area I. Surface Area I shall receive a two toned finish. The color and texture of the architectural finish is shown in the plans.

Finish all TMS concrete structures with a Grade I Class B, Type I finish or as approved by the engineer.

--Item 428--

Provide a class I surface treatment to bridge slabs.

--Item 432--

In all riprap slopes, 3 inch diameter weep holes shall be provided at 10 foot maximum spacing and backed with loose graded gravel or crushed stone and galvanized hardware cloth.

In areas where guard fence posts are to be placed in riprap, the riprap shall have an 18 inch +/- blocked out area (round or square).

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--Item 454--

All sealed expansion joints shall receive System II in accordance with Item 446.

For Header-Type Expansion Joints, the following systems are approved:

SSI-XJS

4021 Benbrook Hwy.

Ft. Worth, Texas 76116

817-731-7890

DEGUSSA

WABOCRETE II

Mark Huff

3011 Heatherpark Drive

Kingwood, Texas 77345

(713) 392-4833

--Item 465—

Install 50 feet of trunkline fiber optic cable (single mode) inside all manholes or as shown on plans, racked to the side of the manhole. Provide rack and hooks to support the cable, subsidiary to the various bid items with no direct payment. Partial construction of manholes will not be permitted unless adequate protection is provided by the contractor.

Protect all TMS equipment with metal beam guard fence, terminal anchor sections and single guard rail terminals. Install metal beam guard fence with terminal anchor sections and single guardrail terminal immediately after the creation of the TMS obstruction. Failure to do so will result in stoppage of all other work on the project until the installation of guard fence is complete.

Do not install metal beam guard fence for TMS equipment until the exact location of the TMS equipment to be protected has been determined. Obtain prior approval from the engineer before the metal beam guard fence is installed and prior to ordering materials. Due to field conditions the quantity may be reduced. The engineer's approval does not relieve the contractor of his/her responsibility for correctness. Any adjustments to TMS equipment or metal beam guard fence with TAS and SGT's will be at no cost to the department.

--Item 500--

"Materials on Hand" payments will not be considered in determining percentages used to compute mobilization payments.

--Item 502--

State Standard Sheet(s) "Traffic Control Plan (TCP)" requires that certain signs remain in place until the standard pavement markings are placed. The standard markings should be in place no later than 14 days after surface treatment operations are completed.

When advanced warning flashing arrow panel(s) is/are specified, one standby unit in good condition shall be at the job site.

Use of shadow vehicles with Truck Mounted Attenuators (TMA) as called for in the State Standard Sheet(s) "Traffic Control Plan" (TCP) is not optional.

Treat pavement drop-offs as shown in the TCP and/or as approved/directed by the Engineer.

After notified in writing by the Engineer, the time frame to provide properly maintained signs and barricades before they are considered in non-compliance, is 48 hours regardless of the days of the week.

Whenever the signals need to be turned off (when directed/approved by the Engineer), hire off-duty law enforcement officers, as covered by Item 9, to control the traffic until the signals are back in satisfactory condition.

Moving an existing sign to a temporary location is subsidiary to this Item. Installations with permanent supports at permanent locations will be paid for under the applicable bid item (s).

Temporary mailboxes shall be mounted on an approved plastic drum in accordance with Compliant Work Zone Traffic Control Devices, Section K. Mounting the mailbox on the drum and moving the drum as needed for the various construction phases will not be paid for directly, but will be considered subsidiary to this Item.

--Item 504--

Furnish one field office Type E. The field office shall have at least 750 square feet and be partitioned into at least 5 workrooms.

The field office shall have a storage area for office technical equipment as directed/approved by the Engineer. The storage area shall be a minimum of 200 cubic feet and shall be reasonably secure from forced entry and removal.

The field office parking area shall be of adequate shape and size to accommodate at least 10 vehicles. When directed by the Engineer (depending on the location), the field office and the parking area shall be enclosed with a fence and have security lighting approved by the Engineer.

If asphaltic material is obtained from a source other than a commercial source presently inspected by TxDOT, furnish a Type D structure for the asphalt mix control laboratory for the

Engineer's exclusive use. This structure shall have a minimum height of 8 feet and provide a minimum of 400 square feet of gross floor area for permanently located asphalt plants or 200 square feet for a temporary plant serving only this project. The floor area will be partitioned into a minimum of two interconnected rooms, with a minimum of two windows per room. The floor shall have an impervious cover and sufficient strength to support the testing equipment. Portable structures shall be support blocked for stability and shall be tied down.

The Type D structure shall be adequately air conditioned and be furnished with a minimum of one desk, three chairs, one file cabinet, a telephone line and one built-in equipment storage cabinet for the storage of equipment. The storage cabinet shall be a minimum of 3 feet wide by 2 feet deep by 3 feet high and shall be reasonably secure from forced entry and removal.

The Type D structure shall be provided with a 240 volt electrical service and a minimum of 2 outlets per wall. Space heaters for heating the structure are unacceptable. Asphalt content will be determined utilizing the Ignition Method, so ensure the electrical wiring of the structure is adequate for the needs of the testing equipment.

Provide the necessary office furniture consisting of desks, chairs, filing cabinets, etc. as directed/approved by the Engineer. Clean the field office and laboratory as needed, but not less than once a week. This will include, but not be limited to, sweeping and mopping floors, cleaning the toilet and lavatory, and emptying waste baskets.

Provide 1 phone line, 1 phone to the State's field office. Provide the Engineer a copy of the monthly phone bill which will be used to monitor phone usage.

In addition to the minimum requirements of DMS-10101, the following requirements apply to this project:

Provide 2 desktop computers, 1 printer, and a High Speed Internet Service Provider (ISP). The complete system including all system cards and peripherals must be FCC Class B device certified.

Provide a paper copier at either the TxDOT or Contractor's field office.

In addition to 8 1/2" x 11", the printer shall be capable of printing 11" x 17" paper size.

Unless otherwise directed/approved by the Engineer, all computer hardware and software will be installed and in operating order in the State's field office prior to the commencement of any work on the project, and shall remain in operating order for the duration of the project.

--Item 506--

It is not anticipated that erosion control devices will be needed. However, in the event that any devices are needed, the SW3P shall consist of the control measures deemed appropriate by the

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Engineer. Depending on the type and amount of work, payment will be handled with the Force Account Procedure, or by individual pay items.

--Item 512--

New Single Slope or F-Shape CTB (cast in accordance with the Standard sheets in the plans) may be furnished or the same pre-used shapes (that meet the requirements of this Item) may be furnished. NEW Safety Shape (New-Jersey) CTB will not be allowed but pre-used New-Jersey (that meets the requirements of this Item) may be furnished.

--Item 529--

Class "C" concrete will be required for machine extruded curb.

Curb inlets and inlet extensions are based on an exposed curb height of 7 inches. The roadway curb height and shape will be transitioned to the inlet's curb with a 40: 1 taper.

--Item 531--

The curb ramp truncated domes will be terra cotta. Stamped concrete is not allowed.

The curb ramp locations shown in the plans have taken into account the geometric features of the intersection (radius, intersecting angle, etc.), traffic signals (if any) and the pavement markings. If anything changes during construction, the location of curb ramps must be adjusted to ensure they meet TAS requirements.

--Item 540--

MBGF posts shall be round with shall have domed tops, and not painted.

Guard fence posts placed in proposed and/or existing areas of riprap, sidewalks or any other concrete shall have an 18 inch +/- (square or round) block out in the concrete. After the posts are installed, the blocked out area shall be topped off with 4 inches of low strength concrete grout mortar consisting of about 1 sack of cement per cubic yard of mix.

If 10 or less timber posts are needed, posts may be purchased locally and will be accepted with visual inspection by the Engineer.

--Item 545--

Contractor is responsible for maintaining and repairing of attenuators during construction.

ITEM 545 VIA OPTION CHART FOR IH 35

TEMPORARY PHASE	STATION	RDWY	SYSTEM	
			QUADGUARD (WIDTH,#BAYS, TYPE)	TRINITY ATTENUATING CRASH CUSION (TYPE,WIDTH,)
1	539+00, RT	SBML	30"W,5 BAY,N	TRACC,N
	673+00, LT	NBML	30"W,5 BAY,N	TRACC,N
2	727+00, LT	NBML	30"W,5 BAY,N	TRACC,N
3	543+00, RT	SBML	30"W,5 BAY,N	TRACC,N
PERMAMENT	697+80, LT	NBML	30"W,5 BAY,N	TRACC,N

--Item 585--

Use Surface Test Type B. Pay Adjustment Schedule 1 to evaluate ride quality of travel lanes.

--Item 610--

To be eligible as a pre-approved shop drawing, the shop drawings must be submitted and approved by the department prior to use. Deviation from pre-approved drawings will require resubmission. Submit drawings, or use pre-approved shop drawings. Shop drawings for roadway illumination assemblies using pre-approved drawings do not have to be submitted.

Ballast/capacitors removed from the light assembly, shall remain the property of the State. Assume all ballast/capacitors contain Polychlorinated Biphenyl (PCB), unless a notation appears on the outside of the unit that specifies it does not contain PCB's or it has an imprinted manufacture date of 1979 or later. All ballast/capacitors with PCB's shall be placed in 55-gallon open top drum that complies with Department of Transportation (DOT) specifications. Six (6) inches of sawdust or other absorbent material shall be placed in the bottom of the drum. Furnish and place a DOT approved PCB warning label on the outside of the drum. A drum shall not be filled to more than $\frac{3}{4}$ capacity.

Avoid rupturing the ballast/capacitor(s). If a ballast/capacitor is ruptured, proper procedures and personal protective equipment is required for the clean-up operations. Specialist trained and equipped staff shall handle the clean-up operations.

The lamps in light fixtures may contain hazardous levels of mercury, halide, and sodium vapors. Observe and comply with all federal, state and local laws, ordinances and regulations regarding the management of these lamps. Prevent the breakage of the lamps. At a minimum, all lamps removed from the light fixture(s) shall be packaged in a container that minimizes the breakage of the lamps. Broken lamps shall be collected in a sealed plastic bag (i.e. Ziploc). Broken and unbroken lamps shall be stored in separate containers. Furnish a suitable container and attach a label stating "Universal Waste Lamps" on the container. Write the date the first lamp was placed in the container on the "Universal Waste Lamp" label. Within one (1) week after the first lamp is placed in a container, notify the Engineer.

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The lamps and PCB containing ballast/capacitors, placed in properly labeled containers, will remain the property of the State. Place the containers in an area where it is protected from damage and the elements. Notify the Engineer when the container(s) is/are ready for transport. The Engineer will make arrangements to collect, transport, and dispose/recycle the containers. The ballast/capacitor and lamp's removal and storage is subsidiary to this item.

Fabricate roadway illumination assemblies in accordance with shop drawings approved by the department. Submit shop drawings for each project, or use pre-approved standard shop drawings.

For project specific shop drawings, furnish seven sets of drawings of the complete assembly in accordance with item 441, "steel structures". Deliver shop drawings to the engineer at the project address.

To be eligible to use pre-approved standard shop drawings, the shop drawing must be submitted and approved by the department prior to use on the project. Deviation from the pre-approved standard shop drawing will require resubmission of the shop drawings. The engineer may approve, in writing, the use of updated standard drawings in cases where the standard drawings have been updated and the updated version has been approved by the department.

For pre-approval and updates to previously approved standard shop drawings, furnish seven sets of drawings of the complete assembly in accordance with item 441, "steel structures" to the director of traffic operations division, Texas Department of Transportation, 125 east 11th street, Austin, Texas 78701-2483.

Copies of the standard shop drawings are on file with traffic operations division, bridge division, and the materials section of construction division. Additional shop drawings for roadway illumination assemblies built in accordance with these drawings are not required. Pre-approved shop drawing manufacturers and assembly model numbers can be found at

<http://www.dot.state.tx.us/business/materialproducerlist.htm>.

Category is roadway illumination and electrical supplies

--Item 618--

It might be necessary to cut existing concrete for placement of conduit. The existing concrete shall be saw cut, removed from the steel reinforcement (bars or fabric) and the steel bent to accommodate the conduit. After the conduit has been placed, the steel shall be bent back to its original position and the trench back-filled with CL "A" concrete. This work is subsidiary to this Item.

The conduit for illumination on City of San Antonio streets shall be installed to a depth of 36 inches.

Make all TMS underground conduit bends of 45 degrees or more in PVC systems, including bends into ground boxes, with rigid metal conduit, subsidiary to the various bid items with no direct payment. Ensure that grounding is in accordance with the ED sheets.

Steel case all TMS PVC bores, subsidiary to the item "conduit" with no direct payment for labor or materials.

Install a permanent pull cord all new TMS conduit and innderducts which do not contain cables. Provide pull cords that have a minimum tensile strength of 1250 lbs. and are flat with footage markings for determining length installed. Provide pull cords that are water-resistant and resistant to environmental conditions within conduit. Pull cords installed will be considered incidental to the various bid items with no direct payment made for labor and materials.

Install a single 1/C #14 AWG insulated wire (tracer wire) in TMS conduit that does not contain copper cables or contains fiber optic cable only and no copper cables, for the purpose of locating that conduit after installation, subsidiary to the item "conduit".

TMS layout sheets may show multiple TMS cabinets at a particular location, however the conduit & cable which interconnects the equipment is not shown and is not included in the quantities unless stated otherwise on plan sheets. These conduit & cable runs which interconnect Fiber hubs and other TMS cabinets foundations to each other are subsidiary to the various bid items with no direct payment.

When installing TMS conduit in areas where riprap presently exists, use care and do not break out more riprap that is necessary for placement of conduit. Replace riprap with concrete to the exact slope, pattern and thickness of the existing riprap, subsidiary to the various bid items with no direct payment

Install TMS concrete encased conduit (except for Multi-duct conduit system) with a minimum of 2 inches of encasement. (See Multi-duct conduit system details for concrete encasement requirements). Provide a template at 5 foot intervals to ensure that the conduit remains in its original position as approved by the engineer. Templates are considered subsidiary to the item "conduit" with no direct payment.

TMS bore lengths shown on plan sheets are approximate. Length of bore is measured starting 3 feet from each edge of pavement, curb and gutter, or any unforeseen existing utility, and balance of conduit run is measured as trenched conduit.

Do not use non-certified persons to perform electrical work. See item 7.15 "Electrical Requirements" for additional details.

Electrical certification may be obtained by contacting the Texas Engineering Extension Service (TEEX) at (979) 845-6563 and asking for information on the TxDOT electrical system cours

Do not use cast iron junction boxes in concrete traffic barriers and single slope traffic barriers. Use polymer concrete junction boxes instead of the cast iron junction boxes shown on standard sheets CTBI (3), CTBI (4), and SSCB (4). Mount the junction boxes flush (+ 0", - 1/2") with concrete surface of concrete barrier.

Use materials from prequalified producers as shown on the construction division (cst) of the Texas Department of Transportation (TxDOT) material producers list. Use the following website to view this list: <http://www.dot.state.tx.us/business/materialproducerlist.htm>

The polymer concrete barrier box will not be paid for separately, but will be considered subsidiary to item 618, "CONDUIT"

--Item 620--

Provide breakaway electrical connectors for breakaway poles. Use Bussman HEBW, Littlefuse LEB, Ferraz-Shawmut FEB, or equal on ungrounded conductors. For grounded conductors, use Bussman HET, Littlefuse LET, Ferraz-Shawmut FEBN, or equal. These breakaway connectors have a white colored marking and a permanently installed solid neutral.

Wire nuts for TMS installations are not be permitted.

In locations where TMS service conductors are routed through ground boxes with other cables, install a section of flexible PVC conduit in the ground box. Route the service conductors through this conduit to keep it separated from other cables. Isolate all other cables in the ground box in the same manner. Furnishing and installing the flexible PVC conduit is subsidiary to the various bid items with no direct payment.

To ensure immediate identification, consistently color code and permanently identify all TMS power conductors, twisted wire pair cables, shielded cables, control cables, and fiber optic cables in all manholes, ground boxes, and at all termination points and splices. Submit a chart or list identifying all cables and conductors in a logical and sequential manner.

Install all TMS conductors and cables continuous and without splices from terminal point to terminal point unless otherwise shown on the plans.

The TMS plans show the conduits numbered and specified cables in specific conduits. The purpose of these notes is to instruct the contractor on how to group the cables in the conduits and not to specify the exact conduit to carry the cables. Except for the main trunklines (4- 3" PVC or 4" PVC Multiduct [2-way] or [4-way, etc], the numbering system is arbitrary and may be set by the contractor.

Provide an electrical conductor insulated ground in accordance with the National Electrical Code for any TMS conduit containing electrical conductors (insulated).

Test all TMS circuits to be clear of faults, grounds or open circuits.

Provide breakaway electrical connectors for breakaway poles. Use Bussman Heb, Littlefuse Leb, Ferraz-Shawmut Feb, or equal on ungrounded conductors. For grounded conductors, use Bussman Het, Littlefuse Let, Ferraz-Shawmut Febn, or equal. These breakaway connectors have a white colored marking and a permanently installed solid neutral. See the latest rid (2) standard for additional details.

--Item 624--

Concrete aprons shall be placed around all ground boxes installed in sodded areas as directed/approved by the Engineer.

The cover shall be legibly imprinted with the words "Danger High Voltage" as required by the State Standard Sheet(s) "Electrical Details". In addition, the cover shall include "Traffic Signal", "TMS", "Illumination", or whatever other system is being housed in the ground box. The ground box locations shown on the plans are approximate and can be moved to better fit field conditions when directed/approved by the Engineer. If possible, the ground boxes should not be placed in sidewalks or driveways.

Place concrete aprons around all TMS ground boxes installed in sodded areas or as directed/approved by the Engineer.

Complete construction of TMS ground boxes within 48 hours after beginning construction for that ground box.

Provide TMS ground boxes as shown on state standard sheet ED (3)-03. Construct the cover of polymer concrete. Legibly imprint the cover with the letters "FTM" - "Danger High Voltage" in minimum 1 inch letters.

--Item 628--

Make all arrangements for electrical service, and for compliance with local standards and practices for proper installations.

Construct the TMS electrical services as shown on the TMS Electrical Service Data sheets.

--Item 636--

On new sign installation, Contractor may adjust the post spacing as per state standard (SMD (2-1)-98, and shall coordinate this adjustment with the Engineer prior to the drilling.

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On sign replacement - plum all existing sign mounts prior to the placement of the new sign panel.

Where plans call for the complete removal of an existing sign assembly and installation of a new sign assembly on the same location, utilize the existing sign footings only after it is determined by the Contractor and verified by the Engineer that the existing footings are in good condition, have not been previously repaired and are both of the same size or larger as the proposed sign supports. If it is determined that the existing stub outs can be utilized, Contractor shall submit to the Engineer shop drawings, for his approval, showing the existing stub out and the proposed base plate assembly prior to the installation of the new sign assembly.

All sign panels of aluminum TYPE "A" scheduled to be replaced shall be field punched.

All sign panels of aluminum TYPE "G" shall have stiffeners as per state standards.

--Item 644--

The wedge anchor system shown on State Standard Sheet SMD (TWT)-02 and the expanded foam foundation covered by note no. 11 on the SMD (SLIP-2)-02 are not allowed. The "Roll Pin" shown on SMD (SLIP-1)-02 is required.

--Item 647--

Prepare a traffic sign inventory prior to the commencement of any sign removal work. The inventory shall show the sign type, size, condition, and location. The inventory shall be approved by the Engineer.

--Item 652--

The removal of highway sign light fixtures includes removing all conduit and conductor down to the foundation and the removal of the circuit protector assembly, if existing.

--Item 656--

Provide the foundation for the controller assembly using the anchor bolts and template supplied by the Engineer. Demonstrate to the Engineer that the field wiring is properly installed, then State or City forces will install the controller assembly, connect the field wiring, set the signal timing, and turn on the controller.

--Item 658--

The removal of existing delineators will not be paid for separately but shall be subsidiary to Item 658.

--Item 666 & 6110--

If TY II material is used (vs. an acrylic or epoxy sealer) as the sealer for the TY I markings, it shall be placed a minimum of 14 calendar days (to provide adequate curing) in advance of the TY I markings.

--Item 672--

The bituminous adhesive shall be heated with equipment approved by the Engineer. The equipment shall be capable of heating and maintaining the adhesive at a temperature in accordance with the manufacture's recommended actions. If any adhesive is burned due to overheating, it shall be replaced. The adhesive will be packaged in cardboard containers weighing less than 100 pounds. Adhesive dispensing equipment shall be truck or trailer mounted. All adhesive material shall be placed directly from the heated dispenser to the pavement. Portable or non-heated containers will not be allowed.

The adhesive application shall be of sufficient thickness so that when the markers are pressed into the adhesive, 1/8" or more adhesive will remain under 100% of the marker. The adhesive should extend not less than 1/2" but not more than 1 1/2" beyond the perimeter of the marker.

The TYPE I-R reflective markers shall have a gray body.

--Item 677--

The mechanical method used for the elimination of existing thermoplastic pavement markings require prior approval from the Engineer.

--Item 680--

Except for the controller, which will be provided and operated by the State or the City, work shall consist of furnishing and installing all required materials and equipment necessary for the complete and operating traffic signal installation at the following intersections:
IH 35 Frontage Roads at Theo/Malone, IH 35 Frontage Roads at Division Ave., IH 35 Frontage Roads at Southcross Blvd., IH 3 Frontage Roads at Military Dr., IH 35 Frontage Roads at Zarzamora Street.

The locations shown on the plans for signal pole foundations, controller foundations, conduit and other items may be adjusted to better fit field conditions as approved/directed by the Engineer.

High pressure sodium lamps shall meet ANSI C78 requirements and shall be the type that extinguishes at the end of usable lamp life and remains extinguished without cycling. 400 watt lamps shall contain less than 4.0 MG of mercury. 250 watt lamps shall contain less than 3.0 MG of mercury. Lamps shall be lead free. Lamps shall pass the Federal Toxic Characterisic Leachate Producure (TCLP). Lamp examples: OSRAM-Sylvania LU400/ECO Plus.

--Item 682--

All signal heads shall be from the same manufacturer.

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All signal faces shall be covered until placed in operation.

All pedestrian signal faces shall be single section incandescent Type. Die cast polycarbonate will be an acceptable material in lieu of die cast aluminum. All mounting attachments shall be constructed of steel pipe and shall be mounted as shown on the plans.

For all proposed mast arm pole assemblies, mounting bracket assembly Option "B" shall be used as shown on the State Standard Sheet(s) "Single Mast Arm Assemblies".

--Item 684--

For each cable terminating in the controller cabinet, an extra 10 ft of cable shall be provided. All cables shall be #12 AWG stranded copper. shall be continuous without splices from terminal point to terminal point. All proposed signal

--Item 686 & 687--

All signal poles shall be from the same manufacturer.

--Item 688--

The sealant used must be approved by the Engineer.

The pedestrian push button shall be raised or flush and be a minimum of 2 inches in the smallest dimension. The force to activate the control shall be no greater than 5 lb/ft. Coordinate the button placement with the ground surface pad for proper access to the button.

The pedestrian push button shall be wired with a 2/C #14 loop detector cable in lieu of a #12 A.W.G. XHHW wire.

--Item 734--

A litter pickup cycle shall be inclusive of the whole project from ROW to ROW, including the traveled roadway.

--Item 738--

A sweeping cycle shall be a moving operation performed at night. The moving operation shall be considered subsidiary to this item and must meet requirements of the Traffic Control Plan standards.

--Item 5010--

Provide 3 transportable cellular telephone (s) for use by State inspection personnel. The cell phone plan selected has to be approved by the Engineer prior to service being provided.

--Item 6007--

All existing signal equipment, conduit, conductor, cable etc. that needs to be removed shall be paid for under this item. All existing signal equipment with the exception of the signal controller

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and equipment shall remain the property of the Contractor. Deliver the controller and related equipment to the San Antonio District Signal shop, located at 4615 NW Loop 410 (corner of IH 410 and Callaghan Road) in San Antonio, Texas.

--Item 6009—ITS SYSTEM SUPPORT EQUIPMENT--

Furnish the following TMS equipment to TRANSGUIDE maintenance, meeting the specifications in this contract:

One (1) Radar Vehicle Sensing Device with all mounting hardware

--Item 6010—COMMUNICATION CABLE

Splices of communication cable are not allowed on this project. Test all pairs to ensure they are good before installation.

If any existing TMS communication cable that is shown to remain is damaged, it will be replaced in its entirety (terminal point to terminal point – no splices allowed) at no cost to the department. Replace and make fully operational any cable damaged within 48 hours after damage is detected.

Provide cable of size and gauge as shown on plans.

Rack TMS communication cables to side of any manhole it passes thru. Provide 1 1/2 turns of cable in each ground box or manhole it passes thru.

Ground the communication cable shield for the CCTV camera in the CCTV equipment cabinet.

--Item 6038--

Furnish four (4) Portable Changeable Message Signs, to be placed as shown on plans and as directed by the Engineer. Keep one spare Portable Changeable Message Sign available at all times.

--Item 6431—DUAL OC-3 ATM MPEG-2 ENCODER

Provide dual ATM Multimode interface dual video encoders for this project.

--Item 6430-- FIBER OPTIC CABLE (SINGLE MODE)

This project requires the placement of fiber optic cable. In situations where the new fiber optic cable placed by the contractor is spliced to existing TxDOT fiber optic cable, it is the

responsibility of the contractor to ensure that the new fiber optic cable is compatible with the existing TxDOT fiber optic cable. Splicing fiber optic cable of different manufacturers may result in signal degradation as measured through splice loss and DB loss per mile. The contractor must supply documentation of the compatibility of the fiber types with the fiber optic cable submittals. If testing of the new fiber optic cable after installation shows evidence of signal degradation outside of tolerable specifications due to the use of different fiber types, the contractor is responsible for replacing the newly installed fiber optic cable with material that results in signal quality within specifications. A TxDOT representative will be present while the contractor is splicing fibers from two different manufacturers.

The contractor is responsible for testing any existing Fiber Optic cable strands that will be used for the communication links back to TransGuide (any existing fiber back to TransGuide to which new fiber will be spliced) for new or relocated TMS equipment, identifying which fibers can be used and ensuring that the Fiber Optic cable meets requirements stated in Fiber Optic Cable specification for dB loss.

Any existing TMS fiber optic cable damaged during construction will be replaced within 48 hours after detection of damage. The Contractor will be required to test the fiber and provide such tests to the Engineer for determining suitability for splicing. If no splice is permitted, the Contractor will replace the entire run (approx. 15,000 ft or actual length) at no direct cost to the Department. All fiber provided, tested and spliced will be in accordance with special specification "Fiber Optic Cable (Single Mode)".

Install 50 feet of slack of "trunkline" fiber optic cable in each manhole that fiber passes thru, racked to side of manholes using support hooks. Rack and hooks are subsidiary to the item manhole with no direct payment.

Use ST connectors where fiber optic cables terminate in TMS equipment.

All fiber optic cable splices and connectors are subsidiary to the item "Fiber Optical Cable (Single Mode)", with no direct payment.

--ITEM 6429—REMOVE AND RELOCATE EXISTING TRAFFIC MANAGEMENT EQUIPMENT

Verify the location of other sign panels on the overhead sign bridges in the field prior to installation of the DMS.

Provide all conduit and cables from Dynamic Message Signs to DMS controllers and from all LCS heads to LCS controllers, subsidiary to this item with no direct payment. Submit to the Engineer for approval the mounting details of the Dynamic Message Signs and conduit that are to be installed on existing or proposed structures.

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Contractor is made aware that there are 4 ea DMS TY-3 signs being relocated on this project. The existing DMS poles and signs will be re-used. The contractor must examine the existing drill shaft foundations and pole base plates and provide new drill shaft foundations that have the same bolt pattern as existing foundations.

Galvanize all structural steel, bolts, nuts and washers after fabrication.

Provide structural steel that conforms to A.S.T.M. Specification A-36. Provide clamp bolts that have square heads and hexagon nuts and confirm with A.S.T.M. Specification A-307 and with dimensions in accordance with ANSI B 18.2.1.

Provide aluminum post clamps made of cast aluminum alloy 356-T6. Provide aluminum bolts made of alloy 2024-T4.

Perform all work in accordance with the National Electrical Code.

Provide new pleated air filters in relocated DMS cabinets, relocated LCS cabinets, and relocated Fiber Hubs. Fiberglass air filters are not acceptable.

Conduct all Lane Control System (LCS) testing at night with full closure or as approved by the Engineer.

Ensure that all alarms connected to the existing Network Management System are made operational in all relocated cabinets and Fiber Hubs.

Numbers assigned on the plans for Fiber Hubs are strictly for identification within the construction plans and are not to be used for programming the TMS equipment. Contact TransGuide automation for equipment numbers.

No portable notebook computers are required for the TMS portion of this project.

--Item 6424-- CAMERA POLE STRUCTURE

The camera pole may be twelve (12) sided.

--Item 6427—MULTI-DUCT CONDUIT SYSTEM--

Lengths of Multi-duct conduit system (trenched, bored, or trenched in roadway) are measured by length of system, not total of lengths of conduits installed. For example, a 20 ft length of conduit system is measured as 20 feet, regardless of whether it is a 2-way system, 4-way system or any other number of conduits system.

Install a pull rope in each Innerduct and plug any unused Innerduct. Provide plugs with eye's for attaching the pull rope.

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Submit to the engineer for approval attachment details for Fiberglass Multi-duct system hung on bridges. Use Omni duct (Opti-com Mfg.) or equivalent hanging system or as approved by the engineer. Use manufacturer's recommended spacing of hangers and expansion joints.

--Item xxxx--SOFTWARE SYSTEM INTERFACE

Provide data stream and protocol for items "Fiber Optic Dynamic Message Sign System", CCTV Field Equipment", and "Radar Vehicle Sensing Device" as specified in special specification "Software System Interface". Do not submit any other data stream or protocol.

Do not install computer or gateway hardware between the field controllers and the computer network.

Engineer will not accept any other solutions other than those specified within the special specification "Software System Interface".

--Item xxxx-- CCTV FIELD EQUIPMENT

Ensure that all underground coaxial cable is RG-11 (double shielded).

Furnish and install CCTV communication/power cables recommended or supplied by the manufacturer of CCTV. If no recommendation for communication/power cables is made by manufacturer of CCTV, the following cable to conduit assignment will be followed:

Conduit #1: Install coaxial drop cable and CCTV control cable.

Conduit #2: Install CCTV power cable.

If the CCTV power cable carries 24 VDC, then the power cable may be installed in the same conduit with the coaxial drop cable. If the CCTV control cables carry 115 VAC, then the control cables must be installed with the 115 VAC power cable in conduit #2.

In cases where the CCTV equipment and conduit are to be mounted on an existing and proposed structure, review the structure and submit the mounting details to the engineer for approval.

--Item 6426-- FINAL ACCEPTANCE PLAN

The 60 day test will begin only when all TMS equipment installation, cabling, wiring, testing, field work, TRANSGUIDE operations center work, etc. for the entire project is completed and acceptable to TxDOT. Partial testing is not allowed.

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COUNTY : BEXAR

TEXAS DEPARTMENT OF TRANSPORTATION

GOVERNING SPECIFICATIONS AND SPECIAL PROVISIONS

ALL SPECIFICATIONS AND SPECIAL PROVISIONS APPLICABLE TO THIS PROJECT
ARE IDENTIFIED AS FOLLOWS:

STANDARD SPECIFICATIONS: ADOPTED BY THE TEXAS DEPARTMENT OF
----- TRANSPORTATION JUNE 1, 2004.
STANDARD SPECIFICATIONS ARE INCORPORATED
INTO THE CONTRACT BY REFERENCE.

ITEMS 1 TO 9 INCL., GENERAL REQUIREMENTS AND COVENANTS
ITEM 100 PREPARING RIGHT OF WAY (103)
ITEM 105 REMOVING STABILIZED BASE AND ASPHALT PAVEMENT
ITEM 110 EXCAVATION (132)
ITEM 132 EMBANKMENT (100) (204) (210) (216) (400)
ITEM 161 COMPOST (160)
ITEM 162 SODDING FOR EROSION CONTROL (166) (168)
ITEM 168 VEGETATIVE WATERING
ITEM 247 FLEXIBLE BASE (105) (204) (210) (216) (520)
ITEM 260 LIME TREATMENT (ROAD-MIXED) (105) (132) (204) (210) (300)
(310) (520)
ITEM 340 DENSE-GRADED HOT-MIX ASPHALT (METHOD) (210) (300) (301)
(320) (520) (585)
ITEM 341 DENSE-GRADED HOT-MIX ASPHALT (QC/QA) (210) (300) (301) (320)
(520) (585)
ITEM 354 PLANING AND TEXTURING PAVEMENT
ITEM 360 CONCRETE PAVEMENT (300) (420) (421) (438) (440) (529) (585)
ITEM 361 FULL-DEPTH REPAIR OF CONCRETE PAVEMENT (300) (340) (360)
(421) (440)
ITEM 400 EXCAVATION AND BACKFILL FOR STRUCTURES (132) (401) (420)
(421)
ITEM 403 TEMPORARY SPECIAL SHORING (423)
ITEM 416 DRILLED SHAFT FOUNDATIONS (420) (421) (440) (448)
ITEM 420 CONCRETE STRUCTURES (400) (404) (421) (426) (427) (438) (440)
(441) (448)
ITEM 423 RETAINING WALLS (110) (132) (400) (420) (421) (424) (440) (445)
(458) (556)
ITEM 425 PRECAST PRESTRESSED CONCRETE STRUCTURAL MEMBERS (420)
(421) (424) (426) (427) (434) (440) (442)
ITEM 427 SURFACE FINISHES FOR CONCRETE (420)

ITEM 430 EXTENDING CONCRETE STRUCTURES (420) (421) (440) (448)
 ITEM 432 RIPRAP (247) (420) (421) (427) (431) (440)
 ITEM 442 METAL FOR STRUCTURES (441) (445) (446) (447) (448) (449)
 ITEM 450 RAILING (420) (421) (424) (440) (441) (442) (445) (446) (448)
 (540)
 ITEM 454 BRIDGE EXPANSION JOINTS (429) (442)
 ITEM 464 REINFORCED CONCRETE PIPE (400) (476)
 ITEM 465 MANHOLES AND INLETS (400) (420) (421) (440) (471)
 ITEM 471 FRAMES, GRATES, RINGS, AND COVERS (441) (445) (448)
 ITEM 479 ADJUSTING MANHOLES AND INLETS (400) (421) (465)
 ITEM 500 MOBILIZATION
 ITEM 502 BARRICADES, SIGNS, AND TRAFFIC HANDLING
 ITEM 504 FIELD OFFICE AND LABORATORY (5010)
 ITEM 506 TEMPORARY EROSION, SEDIMENTATION, AND ENVIRONMENTAL
 CONTROLS (432) (556)
 ITEM 512 PORTABLE CONCRETE TRAFFIC BARRIER (420) (421) (424) (440)
 (442)
 ITEM 514 PERMANENT CONCRETE TRAFFIC BARRIER (400) (416) (420) (421)
 (424) (440) (442) (448)
 ITEM 529 CONCRETE CURB, GUTTER, AND COMBINED CURB AND GUTTER (360)
 (420) (421) (440)
 ITEM 530 INTERSECTIONS, DRIVEWAYS, AND TURNOUTS (247) (260) (263)
 (275) (276) (292) (316) (330) (334) (340) (360) (421) (440)
 ITEM 531 SIDEWALKS (104) (360) (420) (421) (440) (530)
 ITEM 536 CONCRETE MEDIANS AND DIRECTIONAL ISLANDS (420) (421) (427)
 (440) (529)
 ITEM 540 METAL BEAM GUARD FENCE (421) (445) (529) (542) (544)
 ITEM 544 GUARDRAIL END TREATMENTS
 ITEM 545 CRASH CUSHION ATTENUATORS (421)
 ITEM 610 ROADWAY ILLUMINATION ASSEMBLIES (421) (441) (442) (445) (446)
 (449) (616) (620)
 ITEM 617 TEMPORARY ROADWAY ILLUMINATION (416) (610) (613) (614) (618)
 (620) (621) (622) (624) (627) (628)
 ITEM 618 CONDUIT (400) (445) (476) (622)
 ITEM 620 ELECTRICAL CONDUCTORS
 ITEM 624 GROUND BOXES (421) (440)
 ITEM 628 ELECTRICAL SERVICES (441) (445) (449) (618) (620) (627) (656)
 ITEM 636 ALUMINUM SIGNS (643)
 ITEM 644 SMALL ROADSIDE SIGN SUPPORTS AND ASSEMBLIES (421) (440)
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 ITEM 647 LARGE ROADSIDE SIGN SUPPORTS AND ASSEMBLIES (421) (440)
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 ITEM 650 OVERHEAD SIGN SUPPORTS (416) (420) (421) (441) (442) (445)
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 ITEM 652 HIGHWAY SIGN LIGHTING FIXTURES (616) (618) (620)
 ITEM 658 DELINEATOR AND OBJECT MARKER ASSEMBLIES (445)
 ITEM 662 WORK ZONE PAVEMENT MARKINGS (666) (668) (672) (677)
 ITEM 666 REFLECTORIZED PAVEMENT MARKINGS (316) (318) (662) (677) (678)
 ITEM 672 RAISED PAVEMENT MARKERS (677) (678)
 ITEM 677 ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS (300)
 (302) (316)
 ITEM 680 INSTALLATION OF HIGHWAY TRAFFIC SIGNALS (610) (625) (627)
 (634) (636) (656)
 ITEM 682 VEHICLE AND PEDESTRIAN SIGNAL HEADS

ITEM 686 TRAFFIC SIGNAL POLE ASSEMBLIES (STEEL) (416) (421) (441)
 (442) (445) (449)
 ITEM 734 LITTER REMOVAL
 ITEM 738 CLEANING AND SWEEPING HIGHWAYS

SPECIAL PROVISIONS: SPECIAL PROVISIONS WILL GOVERN AND TAKE
 ----- PRECEDENCE OVER THE SPECIFICATIONS ENUMERATED
 HEREON WHEREVER IN CONFLICT THEREWITH.

REQUIRED CONTRACT PROVISIONS, FEDERAL-AID CONSTRUCTION CONTRACTS
 (FORM FHWA 1273, DECEMBER, 1993)

WAGE RATES

SPECIAL PROVISION "SCHEDULE OF LIQUIDATED DAMAGES" (000---275)
 SPECIAL PROVISION "IMPORTANT NOTICE TO CONTRACTORS" (000---550)
 SPECIAL PROVISION "PARTNERING" (000---002)
 SPECIAL PROVISION "NOTICE TO ALL BIDDERS" (000---003)
 SPECIAL PROVISION "NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO
 ENSURE EQUAL EMPLOYMENT OPPORTUNITY" (000---004)
 SPECIAL PROVISION "DISADVANTAGED BUSINESS ENTERPRISE IN FEDERAL-AID
 CONSTRUCTION" (000---461)
 SPECIAL PROVISION "STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
 CONSTRUCTION CONTRACT SPECIFICATIONS" (000---006)
 SPECIAL PROVISION "OPTIONAL TRAINING" (000---008)
 SPECIAL PROVISION "CERTIFICATION OF NONDISCRIMINATION IN EMPLOYMENT"
 (000---009)
 SPECIAL PROVISION "DEPARTMENT DIVISION MAILING AND PHYSICAL ADDRESS"
 (000---011)
 SPECIAL PROVISION TO ITEM 3 (003---020)
 SPECIAL PROVISION TO ITEM 5 (005---001)
 SPECIAL PROVISIONS TO ITEM 6 (006---018) (006---020)
 SPECIAL PROVISION TO ITEM 7 (007---213)
 SPECIAL PROVISION TO ITEM 9 (009---009)
 SPECIAL PROVISION TO ITEM 100 (100---001)
 SPECIAL PROVISION TO ITEM 260 (260---001)
 SPECIAL PROVISION TO ITEM 360 (360---003)
 SPECIAL PROVISION TO ITEM 416 (416---001)
 SPECIAL PROVISION TO ITEM 420 (420---003)
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 SPECIAL PROVISION TO ITEM 434 (434---003)
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 SPECIAL PROVISION TO ITEM 442 (442---005)
 SPECIAL PROVISION TO ITEM 447 (447---002)
 SPECIAL PROVISION TO ITEM 500 (500---002)
 SPECIAL PROVISION TO ITEM 502 (502---022)
 SPECIAL PROVISION TO ITEM 512 (512---001)
 SPECIAL PROVISION TO ITEM 514 (514---001)
 SPECIAL PROVISION TO ITEM 620 (620---001)
 SPECIAL PROVISION TO ITEM 658 (658---006)

SPECIAL SPECIFICATIONS:

- ITEM 4116 SOIL NAIL ANCHORS (440)
- ITEM 5010 TRANSPORTABLE CELLULAR TELEPHONES
- ITEM 5018 INCENTIVE FOR USING NON-ROAD DIESEL EQUIPMENT POWERED BY
EPA TIER 1, 2, OR 3 DIESEL ENGINES IN NONATTAINMENT AND
AFFECTED COUNTIES
- ITEM 5344 WATER TANK AND PUMP
- ITEM 5345 STEEL OR POLYETHYLENE MOBILE WATER STORAGE TANK
- ITEM 6006 SPREAD SPECTRUM RADIOS FOR TRAFFIC SIGNALS
- ITEM 6007 REMOVING TRAFFIC SIGNALS
- ITEM 6008 SHIFTING OR REMOVING EXISTING OVERHEAD SIGNS
- ITEM 6009 ITS SYSTEM SUPPORT EQUIPMENT (6011)(6013)
- ITEM 6010 COMMUNICATION CABLE
- ITEM 6011 TESTING, TRAINING, DOCUMENTATION, FINAL ACCEPTANCE AND
WARRANTY
- ITEM 6013 ELECTRONIC COMPONENTS
- ITEM 6038 PORTABLE CHANGEABLE MESSAGE SIGN
- ITEM 6110 REFLECTORIZED PAVEMENT MARKINGS WITH RETROREFLECTIVE
REQUIRMENTS
- ITEM 6266 VIDEO IMAGING VEHICLE DETECTION SYSTEM
- ITEM 6423 CCTV EQUIPMENT CABINET
- ITEM 6424 CAMERA POLE STRUCTURE (441)(442)(447)(449)
- ITEM 6426 FINAL ACCEPTANCE PLAN
- ITEM 6427 MULTI-DUCT CONDUIT SYSTEM
- ITEM 6428 RADAR VEHICLE SENSING DEVICE (6448)
- ITEM 6429 REMOVE AND RELOCATE EXISTING TRAFFIC MANAGEMENT EQUIPMENT
- ITEM 6430 FIBER OPTIC CABLE (SINGLE MODE) (6011)(6013)
- ITEM 6431 DUAL OC-3 ATM MPEG-2 ENCODER
- ITEM 6439 PREPARATION OF EXISTING CONDUIT
- ITEM 6440 DUAL OC-3 ATM MPEG-2 DECODER
- ITEM 6441 CCTV FIELD EQUIPMENT (6448)
- ITEM 6446 SINGLE MODE FIBER OPTIC VIDEO/DATA TRANSCEIVER EQUIPMENT
- ITEM 6447 WIRELESS RADIO CCTV
- ITEM 6448 SOFTWARE SYSTEM INTERFACE

GENERAL: THE ABOVE-LISTED SPECIFICATION ITEMS ARE THOSE UNDER WHICH
----- PAYMENT IS TO BE MADE. THESE, TOGETHER WITH SUCH OTHER
PERTINENT ITEMS, IF ANY, AS MAY BE REFERRED TO IN THE ABOVE-
LISTED SPECIFICATION ITEMS, AND INCLUDING THE SPECIAL
PROVISIONS LISTED ABOVE, CONSTITUTE THE COMPLETE SPECIFI-
CATIONS FOR THIS PROJECT.

SPECIAL PROVISION

003---020

Award and Execution of Contract

For this project, Item 003, “Award and Execution of Contract,” of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 3.4, Execution of Contract, Section B, Bonds is supplemented by the following:

Provide a retainage bond in the amount of 10% of the total amount paid on the contract. The retainage bond is to be used as a guaranty for the protection of any claimants and the Department for overpayments, liquidated damages, and other deductions or damages owed by the Contractor in connection with the Contract.

SPECIAL PROVISION**006---020****Control of Materials**

For this project, Item 006, “Control of Materials,” of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 6.10. Hazardous Materials. The second paragraph is voided and replaced by the following:

When the Contractor encounters existing materials on sites owned or controlled by the State or in required material sources that are suspected by visual observation or smell to contain hazardous materials/waste, the Contractor shall immediately notify the Engineer.

A. The Contractor shall be responsible for all work within the limits identified in the Waste Management Plan (WMP). Item 416, “Drill Shafts”, related work within the limits of the WMP shall be measured and paid for as specified under the respective items. Within the limits of the WMP, field screening tests of soil and groundwater for contamination; construction equipment decontamination costs; other items, that involve handling contaminated soil or water; contaminated wastewater storage, contaminated water dewatering; and, any hazardous materials/waste collection, handling, storage, and transportation costs shall be paid for under Article 9.4, Force Account.

B. TxDOT will be responsible for the testing and disposition of hazardous materials/waste on sites owned or controlled by TxDOT, except as noted in **a.** above, related to work within the limits of the WMP.

The Engineer may suspend the work wholly or in part during the testing, removal or disposition of hazardous materials/waste on sites owned or controlled by TxDOT.

This Item is supplemented by the following:

6.12. Waste Management Plan.**A. Overview**

Construction of the planned roadway and utility improvements for the IH 35 between US 90 and Zarzamora St. project will require monitoring and management of potential Tetrachloroethylene (**PCE**) and Trichloroethylene (**TCE**) contaminated soils and groundwater. Environmental subsurface investigations were conducted by Air Force to determine the absence or presence of solvents released from Aircraft Maintenance operations at Kelly Air Force Base (KAFB). Results of this investigations identified Tetrachloroethylene (**PCE**) and Trichloroethylene (**TCE**) in the subsurface soils and groundwater within the project limits of IH 35 between US 90 and

Zarzamora St. The investigations for the project area have identified areas of known contamination (see Table 1 and Table 2, and as shown in the Plans) where affected soil and groundwater will be potentially encountered.

Contaminated soils encountered in the project limits may be categorized as special waste. Special waste type contaminants may be encountered in subsurface soils generated by construction activities. All potentially impacted soils must be managed according to applicable environmental rules, regulations, TxDOT procedures, and the guidelines set forth in this plan. Construction practices must comply with all applicable regulations concerning the prevention of storm water pollution, as detailed in TxDOT's Storm Water Pollution Prevention Plan (SW₃P).

TxDOT or their designated representative shall be on site to confirm field-screening samples of excavated soils are conducted by the Contractor's Representative. Monitoring excavations will cease outside the limits unless contamination is detected. Field Screening activities will consist of soils inspection, incidental odors, and using a field-screening device.

TxDOT shall be notified immediately when suspect contaminated soils and/or groundwater are encountered at locations not identified in this report. The notification should include the station number, type of contaminated media, evidence of contamination, and measures taken to contain the contaminated media and prevent public access. Contaminated soil and/or groundwater shall not be removed from the location without prior TXDOT approval.

Soils excavated from areas not addressed in this report and that do not exhibit signs of contamination shall be handled as non-contaminated material and managed separately from suspect contaminated soils.

Groundwater and surface intrusion water within the Areas of Concern as described in Table 1, Table 2, and as shown in the Plans will require management and disposal in accordance with the waste practices described in this WMP.

Soils, sediments, groundwater and/or surface intrusion water from potentially contaminated areas will not become the property of the Contractor.

B. Site Contaminants and Concentrations.

Table 1 identifies the contaminant of concern by location and media with the approximate limits identified by station number. Table 2 identifies the analytical information for the Areas of Concern. A soil vapor survey was not performed during this investigation.

TABLE 1

PROJECT DATA SUMMARY
Environmental Data
IH 35 Project, San Antonio, Texas

AOC	From Station No.	To Station No.	Location	Contamination	Contaminant Type On-Site Monitoring Required
				Ground water/Soil	
1) IH35 @ Division	578+00	584+00	Bridge Drill Shaft	Yes / 25-35ft	Special Waste/ Yes
2) STR # 5	592+85	-	OSB Drill Shaft	Yes / 25-35ft	Special Waste/ Yes

* Overhead Sign Bridge (OSB)

* Structure (STR)

TABLE 2

PROJECT CONTAMINATION RESULTS
(Maximum Concentrations)
IH 35 Project - San Antonio, Texas

	AOC No. 1 and 2 Groundwater (ppb)	AOC No. 1 and 2 Soil (ppb)
Tetrachloroethylene (PCE)	10	*
Trichloroethylene (TCE)	10	*

* The concentration of contaminates in the soil are not anticipated to be greater than the concentration of contaminates in the groundwater.

C. Soil Management Procedures within Contaminated Locations.

These general design considerations are applicable to the locations identified in Table 1. The best available engineering controls shall be utilized to minimize potential on-site and off-site impacts to human health and the environment from construction in locations with known or suspected contamination. Management of this waste shall be governed at a minimum by the following management procedures and guidelines.

TxDOT or their designated representative shall be on site to confirm field-screening samples of excavated soils are conducted by the Contractor's Representative. The field screening activities shall be conducted during the auguring activities throughout the Area of Concern. Monitoring excavations will cease outside the limits unless contamination is detected. Field Screening activities will consist of soils inspection, incidental odors, and using a field-screening device.

Area of Concern No.1 and 2 as described in Table 1, Table 2, and as shown in the Plans – Soils removed from the drill shaft from the ground surface and below are considered contaminated. The Contractor shall excavate and load and secure the contaminated soils into roll-off dumpsters provided by others (Specialty Contractor) for transport to a disposal facility by others (Specialty Contractor). The Specialty Contractor is employed by TxDOT. Adequate notification to TxDOT for the scheduling of the Specialty Contractor is required. A minimum of a one-week notification for scheduling of the Specialty Contractor is required. Daily schedules will be coordinated in a preconstruction conference prior to excavation in this location and as construction progresses.

All excavated soil shall be appropriately managed in accordance with this Waste Management Plan. No unprotected, excavated contaminated soils shall remain on site at the end of the workday without TxDOT approval. Excavations shall be opened and closed within the same working day to minimize surface water contact with potentially contaminated soils. Excavations that are left open overnight with TxDOT approval shall be bermed to prevent run-on and controlled (i.e. fencing, trench covers, warning signs, barricades) to prevent public access.

D. Groundwater Management and Surface Water Intrusion Procedures.

The maximum concentrations of constituents detected in the groundwater samples within the project limits are presented in Table 2. Depth to groundwater within the proposed construction may vary with seasonal changes. However, groundwater was encountered during environmental investigations of the site at depths of 25 to 35-ft. below ground surface at Areas of Concern No.1 and 2.

Groundwater removed from any location within the contaminated areas identified in Table 1 may potentially contain Tetrachloroethylene (PCE) and Trichloroethylene (TCE) and must be collected, containerized and tested to determine disposal options.

All groundwater and surface intrusion water, including water from broken water lines, which contacts soils within the designated contaminated areas, as show in the plans and described in Table 1, shall be collected, transported and managed in an appropriate tank provided by the contractor, within TxDOT ROW, as approved by the Engineer. TxDOT will be responsible for testing and disposal of contaminated water. Pumps and tanks shall be decontaminated before reuse at other contaminated locations or clean locations.

A secured temporary storage tank area shall be located within the project limits for a minimum of one 21,000-gallon temporary storage tank, as approved by the Engineer. This tank shall be of sufficient capacity to handle and segregate the volume of construction-generated wastewater. The tank shall be placed on pavement or a liner of PVC, LLPDE, HDPE or a product approved by the Engineer to prevent spills from making contact with soils. Tank leaks shall be repaired immediately. The secured temporary storage tank area will require a management plan to prevent surface water from entering the tank area and to contain any minor spills from wastewater handling. This Plan and secured tank storage location must be submitted to the Engineer in writing, and approved by TxDOT.

The Contractor shall notify TxDOT when the capacity of the tank is estimated at 75% of capacity. Upon notification, TxDOT shall perform analysis of the tank contents. Non-

contaminated, non-sediment laden water may be discharged into the TxDOT's storm sewer system. TxDOT shall dispose of contaminated water. Estimated time for analysis and disposal is two weeks.

E. Stormwater Pollution Prevention (SW3P) Requirements.

These requirements for an SW3P herein as presented to prevent degradation of receiving waters in accordance with the planned construction activities to comply with Federal, State and local regulations. The contractor shall review, understand, implement and inspect both the general SW3P and the following additional SW3P requirements presented below for the contaminated locations and associated staging areas identified in this section.

The following SW3P requirements are specific to construction activities that will occur within all locations previously identified in Table 1. This subsection describes construction practices within the contaminated locations, soil stockpile and water containment areas and specific requirements for locations identified as potentially containing contaminated wastes. Decontamination procedures shall be selected and implemented by the Contractor. Decontamination measures, including management and disposal shall be incorporated into the SW3P. Decontamination of equipment must be conducted prior to moving from a suspect contaminated area to a non-contaminated area.

The Contractor shall limit tracking soil from contaminated areas into non-contaminated areas by minimizing wet soil removal operations. The Contractor shall construct a decontamination pad or a method of decontamination that will be used to prevent offsite tracking of contaminants during construction activities. The Contractor shall remove excess soil from equipment and trucks prior to exiting contaminated locations either by dry decontamination or by cleaning at a decontamination pad with a pressure washer. Dry decontamination methods, i.e., using a broom to remove visible soil, are preferred. If wet methods are employed, the Contractor shall utilize methods to minimize waste generation and contain all fluids from running off the site.

The Contractor shall be required to document decontamination of heavy equipment, and drilling rigs (including augers) when moving from a suspect contaminated to a non-contaminated area. Soils from potential impacted areas shall not be tracked on roadways. Any soils tracked onto roadways shall be immediately removed. These decontamination wastes shall be placed into appropriate containers for characterization and profiling prior to final disposal. The Contractor at his discretion will place the decontamination waste with the suspect contaminated soil. TxDOT is responsible for waste disposal associated with the contaminated areas.

F. Health and Safety Plan Requirements.

Prudent safety and health measures and monitoring should be conducted during construction activities in the areas described in Table 1 and Table 2.

The work includes potential exposure to soil and groundwater contaminants. The Contractor shall prepare and follow a Site Health and Safety Plan (SHSP) that has been written in accordance with and in fulfillment of Occupational Safety and Health Administration (OSHA) regulations, and all other applicable laws, ordinances and regulations. The Contractor shall be solely responsible for their SHSP and compliance with its requirements in performing the work.

A copy of the SHSP, including any revisions or changes, and any required documentation shall be maintained on site and be available for review by the Engineer. Upon request the SHSP, including any revisions or changes, and any required documentation shall be provided to the Engineer.

SPECIAL PROVISION

100---001

Preparing Right of Way

For this project, Item 100, “Preparing Right of Way,” of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 100.4. Payment. The second paragraph is voided and replaced by the following:

Total payment of this Item will not exceed 10% of the original contract amount until final acceptance. The remainder will be paid on the estimate after the final acceptance under Article 5.8, “Final Acceptance.”

SPECIAL PROVISION

260---001

Lime Treatment (Road-Mixed)

For this project, Item 260, "Lime Treatment (Road-Mixed)," of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 260.2. Materials, Section A. Lime. The first two sentences are voided and replaced by the following:

Furnish lime that meets the requirements of DMS-6350 "Lime and Lime Slurry," and DMS-6330, "Prequalification of Lime Sources." Use hydrated lime, commercial lime slurry, quicklime, or carbide lime slurry as shown on the plans.

Article 260.3. Equipment, Section B. Slurry Equipment. The last sentence of the second paragraph is voided and replaced by the following:

Equip the distributor truck with a sampling device in accordance with Tex-600-J, Part I, when using commercial lime slurry or carbide lime slurry.

Article 260.4. Construction, Section C. Application of Lime, Section 2. Slurry Placement. The last sentence of the first paragraph is voided and replaced by the following:

Deliver commercial lime slurry or carbide lime slurry to the jobsite, or use hydrated lime or quicklime to prepare lime slurry at the jobsite or other approved location, as specified.

Article 260.5. Measurement, Section A. Lime is supplemented by the following:

4. Carbide Lime Slurry. Lime slurry will be measured by the ton (dry weight) as calculated from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.

Article 260.6. Payment, Section A. Lime. The first sentence is voided and replaced by the following:

Lime will be paid for at the unit price bid for "Lime" of one of the following types:

- Hydrated Lime (Dry),
- Hydrated Lime (Slurry),
- Commercial Lime Slurry,
- Quicklime (Dry),
- Quicklime (Slurry), or
- Carbide Lime Slurry.

SPECIAL PROVISION

360---003

Concrete Pavement

For this project, Item 360, “Concrete Pavement,” of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 360.3. Equipment, Section E. Curing Equipment. The third sentence is voided and replaced by the following:

Provide curing equipment that is independent of all other equipment when required to meet the requirements of Article 360.4.I, “Curing.”

Article 360.4. Construction, Section H. Spreading and Finishing, Section 2. Maintenance of Surface Moisture. The first and second sentences are voided and replaced by the following:

Prevent surface drying of the pavement before application of the curing system by means that may include water fogging, the use of wind screens and the use of evaporation retardants.

Article 360. 4. Construction, Section I. Curing. The first sentence is voided and replaced by the following:

Keep the concrete pavement surface from drying as described in Section 360.4.H.2, “Maintenance of Surface Moisture,” until the curing material has been applied.

Article 360. 4. Construction, Section I. Curing, Section 1. Membrane Curing. The first paragraph is voided and replaced by the following:

Spray the concrete surface uniformly with 2 coats of membrane curing compound at an individual application rate of not more than 180 sq. ft. per gallon. Do not allow the concrete surface to dry before applying the curing compound. Use a towel or absorptive fabric to remove any standing pools of bleed water that may be present on the surface before applying the curing compound. Apply the first coat within 10 min. after completing texturing operations. Apply the second coat within 30 min. after completing texturing operations.

SPECIAL PROVISION

500---002

Mobilization

For this project, Item 500, “Mobilization,” of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 500.1. Description is supplemented by the following:

Work for this Item includes submissions required by the Contract.

Article 500.3. Payment, Section F is voided and replaced by the following:

F. Upon final acceptance, 97% of the mobilization lump sum bid will be paid. Previous payments under this Item will be deducted from this amount.

Article 500.3. Payment is supplemented by the following:

G. Payment for the remainder of the lump sum bid for “Mobilization” will be made after all submittals are received, final quantities have been determined and when any separate vegetative establishment and maintenance, test and performance periods provided for in the Contract have been successfully completed.

SPECIAL PROVISION

502---022

Barricades, Signs, and Traffic Handling

For this project, Item 502, “Barricades, Signs, and Traffic Handling,” of the Standard Specifications, is hereby amended with respect to the clauses cited below, and no other clauses or requirements of this Item are waived or changed hereby.

Article 502.4. Payment, Section C. Maximum Total Payment Prior to Acceptance is voided and replaced by the following:

C. Maximum Total Payment Prior to Acceptance. The total payment for this Item will not exceed 10% of the total Contract amount before final acceptance in accordance with Article 5.8, “Final Acceptance.” The remaining balance will be paid in accordance with Section 502.4.E, “Balance Due.”

SPECIAL SPECIFICATION**5344****Water Tank and Pump**

- 1. Description.** Furnish and operate vacuum removal or pumping of contaminated groundwater and intrusion water encountered during construction activities within the designated contamination area into a portable storage tank and transported to an off-site storage tank provided by the Contractor.
- 2. Materials.** The pump or vacuum device shall utilize a diaphragm or non-sparking system capable of pumping or withdrawing a minimum of 30 gal. per min. Equip the pump or vacuum device with a meter capable of measuring the amount of water withdrawn or pumped in and out of the portable tank by the gallon.

The tank must hold a minimum of 450 gal. and be constructed of a material that is non reactive to the contaminants that may be encountered as indicated in the Waste Management Plan for IH 35 between US 90 and Zarzamora Project Report for this project.

The portable tank and pump/vacuum system shall be either truck or trailer mounted.

- 3. Measurement.** This Item will be measured by the 1,000 gallons delivered to the approved off-site storage tank provided by the Contractor. The Contractor shall generate a haul ticket indicting the pump meter reading before groundwater is drawn, after the groundwater is pumped into the portable tank and a reading after the groundwater has been relocated to the storage tank.
- 4. Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Water Tank and Pump". This price shall be full compensation for furnishing all equipment, water tank, pump/vacuum system, meters, pumping into the tank, delivering the water to the approved off-site storage tank and for all labor, tools equipment and incidentals.

SPECIAL SPECIFICATION

5345

Steel or Polyethylene Mobile Water Storage Tank

- 1. Description.** Furnish and operate a steel or polyethylene mobile water storage tank to provide adequate temporary storage for construction water or ground water contaminated with petroleum hydrocarbons that is encountered during construction activities, within the designated contamination area. Place the tank within the project limits or at the temporary stockpile storage site shown on the plans as approved by the Engineer. Tanks shall be certified clean upon delivery. Locks for all intake and discharge points shall be supplied with keys. All intake and discharge points shall be closed and locked when not in use.

- 2. Materials.**

Type I. A Type I tank shall be a 21,000 gal. steel water tank not to exceed 8.5 ft. in width and shall not exceed the tank towering height of 13.5 ft. and the overall length shall not exceed 41 ft. The walls and roof shall be corrugated or externally reinforced. The floors shall be "V" shaped. The tanks shall include a minimum of a 2 ft. man way to access the tank for sampling, gauging and inspection. A minimum 3 in. overflow line is required. The topfill nozzle shall be at least 3 in. in diameter. A minimum 4 in. drain valve shall be located at the tank rear and shall have a maximum 4 in. suction valve at the front center of the tank. The tank shall also be equipped with a minimum 2 ft. steel stairway containing a steel handrail.

Type II. A Type II tank shall be a 6,500 gal. polyethylene water storage tank and shall have a diameter not to exceed 12 ft., height not to exceed 14 ft. and equipped with a minimum 2 ft. man way. The top nozzle shall not exceed 4 in. in diameter and shall be equipped with a 50 mm PVC air vent.

- 3. Measurement.** This Item will be measured by the each tank delivered on-site for use in the designated contamination areas on the project.
- 4. Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Mobile Water Storage Tank (Ty I)" or "Mobile Water Storage Tank (Ty II)". This price shall be full compensation for furnishing all equipment, delivery, labor, tools and incidentals necessary to complete the work. TxDOT shall be responsible for disposal of any contaminated water in accordance with all applicable Federal and State regulations.

SPECIAL SPECIFICATION

6439

Preparation of Existing Conduit

1. **Description.** Clear and test existing conduit of all sizes, furnish and install junction boxes in place of existing conduit fittings, replace damaged ground boxes and/or manholes, and install pull lines between ground boxes and manholes.

2. **Materials.**

- A. **General Requirements.** Provide, furnish, and install materials that are new and in strict accordance with the details on the plans and in the Specifications.

- B. **Functional Requirements.** An existing conduit system is in place along the freeway system as shown on the plans. It is recognized that conduits, ground boxes, and manholes may be blocked due to silt accumulation or other debris and there may be breaks in the conduit.

Modify the conduit system if necessary to accommodate the fiber optic cable or other cable selected for installation on this project. Remove silt or debris from conduit, manholes and ground boxes as required to accommodate the cable. Ensure that manholes, junction boxes and ground boxes are large enough and that the conduit is installed in such a way so as to permit the fiber optic cable to be coiled without violating the fiber optic cable manufacturer's minimum bending radius for operation. To provide adequate radii for installation of the fiber optic cable, existing conduit fittings are to be replaced with junction boxes. In locations determined by the Engineer, the existing ground boxes are to be replaced with larger boxes or manholes to provide the required radii for installation of the fiber optic cable.

- C. **Mechanical Requirements.** If it is necessary to replace conduit, provide and install new conduit of the same size and schedule as the conduit it is replacing. Provide replacement conduit that is PVC or RMC and meets the requirements of the TxDOT Specifications for each type of conduit or as directed by the Engineer.

Provide junction boxes that are NEMA rated 4X rain tight gasketed boxes with screw covers, and a minimum size of 24 in. by 24 in. by 12 in. (L x W x D). Provide galvanized steel junction boxes. Typical installations are shown on the plans.

New ground boxes and manholes furnished and installed will be as shown on the plans or as directed by the Engineer.

3. **General.** Check all existing conduit shown on the plans to be used for installation of wire and cables to verify that it is clear and continuous and useable for the intended purpose. Remove all silt and debris from ground boxes and manholes. Find and repair any sections of conduit and clear any ground boxes or manholes which are found to be unacceptable before the cable installation is started.
- A. **Conduit, Ground Boxes, Manholes, Clearing and Testing.** Test all existing conduit to be used on this project by pulling a mandrel through the conduit. Use a mandrel that has a diameter no less than 70% of the inside diameter of the conduit and a length of 2 in. Clean and/or replace all sections of existing conduits that will not allow passage of the mandrel so that the mandrel WILL pass thru the conduit to the satisfaction of the Engineer. After the mandrel test is completed successfully, clean the conduits with a rubber swab slightly larger in diameter than the conduit. Install a nylon pull line with minimum test strength of 200 lb. in the conduit for use in installing the wire and cables. Clear all existing ground boxes and manholes to be used on this project of all silt and debris prior to installing cable.
- B. **Ground Box and Manhole Installation.** In locations where the Engineer determines that the existing ground box or manhole is damaged or too small for the cable installation, furnish and install a new ground box or manhole of a type in accordance with the plans and as directed by the Engineer. Backfill disturbed surface with material equal in composition and density to the surrounding area. Replace surface material with similar material to an equivalent condition.
- C. **Junction Box Installation.** In locations where a conduit fitting exists in the conduit that is to carry the fiber optic cable, replace the fitting and associated sections of conduit with a junction box as directed by the Engineer.
4. **Measurement.** This Item will be measured by the foot of conduit cleared, and tested, and will include the clearing of ground boxes and manholes. Junction boxes installed will be measured as each junction box installed.

New conduits will be measured as each foot of conduit that is installed in accordance with these Specifications.

Ground boxes and manholes will be measured as each of the various types installed in accordance with these Specifications.

5. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Preparation of Existing Conduit", "Multiduct Conduit System", "Manhole", "Conduit", "Ground Box" and "Junction Box" of the type specified. These prices are full compensation for all materials required to meet the requirements of the Special Specifications, for the removal and disposal of all conduit, ground boxes, and manholes being replaced, and for furnishing of all labor, tools, equipment and incidentals.

SPECIAL SPECIFICATION

6447

Wireless Radio CCTV

1. **Description.** Furnish, install, and make fully operational a Wireless Radio Closed Circuit Television (CCTV) at designated locations as shown on the plans and as detailed in accordance with these specifications.
2. **General.** Wireless Radio CCTV is a system that allows cameras to be connected to the TransGuide Advanced Traffic Management System (ATMS) using spread spectrum wireless Ethernet communications equipment. The Wireless Radio CCTV system is comprised of several subsystems which include a Transmitter Site, Repeater Site, a Combination Repeater/Transmitter Site, a Receiver Site, a Decoder Site, and an Upgrade Existing Transmitter Site to a Combination Repeater/Transmitter Site. The following paragraphs provide a description of the sites. Refer to the plans to determine the locations to install the subsystems.
 - A. **Transmitter Site.** Video and control for the camera connect to an Ethernet video encoder located in the CCTV cabinet. The Ethernet video encoder encodes the video and control into Ethernet data. The Ethernet data is sent to a Wireless Bridge located on the camera pole just below the camera. The Wireless Bridge transmits the Ethernet data to either a Repeater Site, a Combination Repeater/Transmitter Site, or to the Receiver Site depending on the arrangement of the sites on the plans.
 - B. **Repeater Site.** The Repeater Site is used to overcome obstacles that prevent a clear line-of-sight between the Transmitter Site and the Receiver Site. The Repeater Site is also used to extend the distance between the Transmitter Site and Repeater Site. Ethernet data (video/control) from a Transmitter Site is received by a Wireless Bridge aimed at the Transmitter Site. The received Ethernet data is transferred to a second Wireless Bridge. The second Wireless Bridge transmits the Ethernet data to either a Receiver Site or on to another Repeater Site.
 - C. **Combination Repeater/Transmitter Site.** Video and control from a remote Transmitter Site is combined with the local video and control and sent to a Receiver Site or on to another Repeater Site. Ethernet data (video/control) from the remote Transmitter Site is received by a Wireless Bridge. Video and control for the local camera is encoded into Ethernet data by an Ethernet video encoder located in the CCTV cabinet. The Ethernet data for the two cameras is networked together by a Field Ethernet switch. A second Wireless Bridge located just below the camera transmits the Ethernet data for the two cameras to the Receiver Site or on to another Repeater Site.
 - D. **Receiver Site.** Ethernet data (video/control) from the remote Transmitter Site(s) is received by a Wireless Bridge located just below the camera. The Wireless Bridge connects to an Ethernet fiber driver located in the CCTV cabinet. The Ethernet fiber

driver converts the Ethernet data into light pulses. The Ethernet fiber driver sends the data over two single-mode fibers to the fiber hub where the fiber is patched to two trunk fibers that connect to the Decoder Site located in the TransGuide Computer Room.

- E. Decoder Site.** The two fibers from the Receiver Site are connected to an Ethernet fiber driver. The Ethernet fiber driver converts the light pulses to Ethernet data and sends the data to an Ethernet video decoder. The Ethernet video decoder converts the Ethernet data back into video and control. The video is sent to an ATM video encoder and the control is sent to the computer room terminal server.
- F. Upgrade Existing Transmitter Site to a Combination Repeater/Transmitter Site.** A Transmitter Site can be upgraded to a Combination Repeater/Transmitter Site to allow the addition of another Transmitter Site to a wireless chain. A second wireless bridge is added to existing Transmitter Site to receive the Ethernet data from a new Transmitter site. A Field Ethernet Switch is added to the existing CCTV cabinet to network the Ethernet data for the two cameras. The existing Wireless Bridge transmits the Ethernet data for the two cameras to the Receiver Site or on to another Repeater Site.

3. Materials. Provide a Wireless Radio CCTV that meets the following requirements.

- A. General Requirements.** Provide only equipment that is new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications. Provide a Wireless Radio CCTV that is fully compatible with existing CCTV subsystem hardware and software.

1. Transmitter Site. Furnish and install a Transmitter Site that consists of all equipment shown below at the locations shown on the plans.

- Temporary Camera Pole (1 required per Transmitter Site)
- CCTV Field Equipment (1 required per Transmitter Site)
- Mounting bracket for camera (1 required per Transmitter Site)
- Lightning Rod (1 required per Transmitter Site)
- CCTV Equipment Cabinet (1 required per Transmitter Site)
- Conduit (as required)
- Wireless Bridge (1 required per Transmitter Site)
- Mounting bracket for Wireless Bridge (1 required per Transmitter Site)
- Ethernet Video Encoder (1 required per Transmitter Site)
- Interconnect Cables (as required)
- Communications Cable (as required)
- Lightning Protector (as required)
- Incidentals (as required)

2. Repeater Site. Furnish and install a Repeater Site that consists of all equipment shown below at the locations shown on the plans.

- Temporary Camera Pole (1 required per Repeater Site)

- Lightning Rod (1 required per Repeater Site)
- CCTV Equipment Cabinet (1 required per Repeater Site)
- Conduit (as required)
- Wireless Bridge (2 required per Repeater Site)
- Mounting bracket for Wireless Bridge (2 required per Repeater Site)
- Interconnect Cables (as required)
- Communications Cable (as required)
- Lightning Protector (as required)
- Incidentals (as required)

3. Combination Repeater/Transmitter Site. Furnish and install a Combination Repeater/Transmitter Site that consists of all equipment shown below at the locations shown on the plans.

- Camera Pole (1 required per Combination Repeater/Transmitter Site)
- CCTV Field Equipment (1 required per Combination Repeater/Transmitter Site)
- Mounting bracket for camera (1 required per Combination Repeater/Transmitter Site)
- Lightning Rod (1 required per Combination Repeater/Transmitter Site)
- CCTV Equipment Cabinet (1 required per Combination Repeater/Transmitter Site)
- Conduit (as required)
- Wireless Bridge (2 required per Combination Repeater/Transmitter Site)
- Mounting bracket for Wireless Bridge (2 required per Combination Repeater/Transmitter Site)
- Ethernet Video Encoder (1 required per Combination Repeater/Transmitter Site)
- Field Ethernet Switch (1 required per Combination Repeater/Transmitter Site)
- Interconnect Cables (as required)
- Communications Cable (as required)
- Lightning Protector (as required)
- Incidentals (as required)

4. Receiver Site. Furnish and install a Receiver Site that consists of all equipment shown below at the locations shown on the plans.

- Camera Pole (as required per Receiver Site)
- Lightning Rod (as required per Receiver Site)
- CCTV Equipment Cabinet (as required per Receiver Site)
- Conduit (as required)

- Wireless Bridge (1 required per Receiver Site)
 - Mounting bracket for Wireless Bridge (1 required per Receiver Site)
 - Ethernet Fiber Driver (1 required per Receiver Site)
 - Interconnect Cables (as required)
 - Communications Cable (as required)
 - Lightning Protector (as required)
 - Incidentals (as required)
- 5. Decoder Site.** Furnish and install a Decoder Site that consists of all equipment shown below in the TransGuide computer room.
- Ethernet Fiber Driver (1 required per Decoder Site)
 - Ethernet Video Decoder (1 required per Transmitter site and 1 required per Combination Repeater/Transmitter Site)
 - Dual OC-3 ATM MPEG-2 Encoder (Dual Encoder, Multimode) (1 required per Decoder Site)
 - Interconnect Cables (as required)
 - Communications Cable (as required)
 - Incidentals (as required)
- 6. Upgrade Existing Transmitter Site to Combination Repeater/Transmitter Site.** Furnish and install the equipment shown below to an existing Transmitter site at locations shown on the plans.
- Field Ethernet Switch (install 1 in existing CCTV cabinet per Upgrade Site)
 - Wireless Bridge (install 1 on existing pole per Upgrade Site)
 - Mounting Bracket for Wireless Bridge (1 required per Upgrade Site)
 - Interconnect Cables (as required)
 - Communications Cable (as required)
 - Lightning Protector (as required)
 - Incidentals (as required)
- B. Field Ethernet Switch.** Furnish and install a Field Ethernet Switch fully compliant with the requirements for the Field Ethernet Switch specification at each designated Combination Repeater/Transmitter Site as shown on the plans. Submit Field Ethernet Switch mounting shop drawings for Engineer approval.
- C. Ethernet Fiber Driver.** Furnish and install an Ethernet Fiber Driver fully compatible with the requirements for the Ethernet fiber driver specification at each designated Receiver Site and Decoder Site as shown on the plans. Submit Ethernet Fiber Driver mounting shop drawings for Engineer approval.
- D. Dual OC-3 ATM MPEG-2 Encoder (Dual Encoder, Multimode).** Furnish and install a Dual OC-3 ATM MPEG-2 Encoder (Dual Encoder, Multimode) fully compatible with the requirements for the Dual OC-3 ATM MPEG-2 Encoder

specification for each designated Decoder Site as shown on the plans. Submit Dual OC-3 ATM MPEG-2 Encoder (Dual Encoder, Multimode) mounting shop drawings for Engineer approval.

- E. CCTV Field Equipment.** Furnish and install a CCTV Field Equipment fully compatible with the requirements for the CCTV Field Equipment specification at each designated Transmitter Site and Combination Repeater/Transmitter Site as shown on the plans. Submit Video Camera mounting shop drawings for Engineer approval.
- F. CCTV Equipment Cabinet.** Furnish and install a CCTV Equipment Cabinet fully compatible with the requirements for the CCTV Equipment Cabinet specification at each designated Transmitter Site, Repeater Site, Combination Repeater/Transmitter Site, and Receiver Site as shown on the plans. Submit shop drawings of cabinet for Engineer approval.
- G. Wireless Bridge.** Furnish and install one Wireless Bridge at each designated Transmitter Site and Receiver Site as shown on the plans and as detailed in accordance with the following requirements. Furnish and install two Wireless Bridges at each designated Repeater Site and Combination Repeater/Transmitter Site as shown on the plans and as detailed in accordance with the following requirements. Use the same manufacturer and model for each Wireless Bridge.
- 1. General Requirements.** Provide only equipment that is new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications. Provide all software, power supplies, and any other equipment or firmware that is associated with the operation of the Wireless Bridge units.
 - 2. Wireless Port.** Provide a Wireless Bridge with the following wireless specifications:
 - 6, 9, 12, 18, 24, 36, 48, and 54 Mbps data rates
 - 5.725 to 5.825 GHz frequency band
 - Coded Orthogonal Frequency Division Multiplexing (COFDM) wireless modulation
 - Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) media access protocol
 - Binary Phase Shift Keying (BPSK) modulation at 6 and 9 Mbps
 - Quadrature Phase Shift Keying (QPSK) modulation at 12 and 18 Mbps
 - 16-Quadrature Amplitude Modulation (QAM) modulation at 24 Mbps and 36 Mbps
 - 64-QAM modulation at 48 Mbps and 54 Mbps
 - Four non-overlapping channels
 - -83 dBm minimum receive sensitivity at 6 and 9 Mbps
 - -81 dBm minimum receive sensitivity at 12 Mbps
 - -80 dBm minimum receive sensitivity at 18 Mbps
 - -77 dBm minimum receive sensitivity at 24 Mbps

- -74 dBm minimum receive sensitivity at 36 Mbps
- -70 dBm minimum receive sensitivity at 48 Mbps
- -68 dBm minimum receive sensitivity at 54 Mbps
- -19 dBm maximum operational receive level
- 0 dBm maximum survivable receive level
- 250 mW (24 dBm), 200 mW (23 dBm), 155 mW (22 dBm), 125 mW (21 dBm), 60 mW (18 dBm), 30 mW (15 dBm), 15 mW (12 dBm) available transmit power settings
- 7.5 miles point-to-point minimum transmission range at 54 Mbps
- 16 miles point-to-point minimum transmission range at 9 Mbps
- 2 miles point-to-multipoint minimum transmission range at 54 Mbps (sector antenna at root)
- 8 miles point-to-multipoint minimum transmission range at 9 Mbps (sector antenna at root)
- Captured Linear Polarization, 22 dBi gain, 10 E-plane by 12 H-plane beamwidth antenna
- Supports 802.1x including Lightweight Extensible Authentication Protocol (LEAP) to yield mutual authentication and dynamic per-user, per-session encryption keys for authentication
- Supports static and dynamic Institute of Electrical and Electronic Engineers (IEEE) 802.11 Wired Equivalent Privacy (WEP) keys of 40 bits and 128 bits
- Supports pre-standard Temporal Key Integrity Protocol (TKIP) WEP enhancements: key hashing (per packet keying) and Message Integrity Check (MIC) for encryption
- Light-Emitting Diodes (LEDs) to indicate install, radio, status, Ethernet
- Received Signal Strength Indicator (RSSI) port for alignment (BNC connector, 0 to 2.7 VDC)

3. Ethernet Port. Provide a Wireless Bridge with an Ethernet port with the following features:

- 10/100Base-T/TX
- RJ-45 female connector
- Automatic and user-selectable half/full duplex setting
- LED link/activity status indicator
- Static IP address configuration

4. Protocols Supported. Provide a Wireless Bridge that supports the following protocols:

- IEEE 802.11a
- IEEE 802.3

- IEEE 802.3u
 - Hyper Text Transport Protocol (HTTP)
 - Simple Network Management Protocol (SNMP) version 2
 - File Transfer Protocol (FTP)
 - Trivial File Transfer Protocol (TFTP)
 - Telnet
5. **Management.** Provide a Wireless Bridge that supports the following management capabilities:
- Web browser/HTTP configuration and management
 - Telnet configuration and management
 - Allow multiple management sessions or automatically terminate existing session when a new session is requested
 - Remotely upgradeable firmware
 - SNMP version 2 device status, diagnostic, and alarm monitoring and remote configuration
 - Request for Comments (RFC)-1213-compliant Management Information Base (MIB) files
 - Standard and device specific MIB2 files
6. **Regulatory Approvals.** Provide a Wireless Bridge that has been certified to the following regulatory standards:
- Operational: Federal Communications Commission (FCC) Part 15 unlicensed wireless operation
 - Product Safety: Underwriters Laboratories (UL) Standard 60950 or 2043
 - Electromagnetic Emissions: FCC Part 15, Class B
7. **Dimensions.** Provide a Wireless Bridge with dimensions that do not exceed the following maximums:
- Height: 4 in.
 - Width: 12 in.
 - Depth: 12 in.
 - Weight: 12 lbs.
8. **Power.** Provide a Wireless Bridge that meets the following power specifications
- 120 VAC
 - 60 Hz
 - Light-Emitting Diodes (LEDs) to indicate power on state
9. **Environmental.** Provide a Wireless Bridge that is designed to operate in the following environmental conditions:

- -30°C to 55°C operating temperature range
- 0 to 100% relative humidity

H. Ethernet Video Encoder. Furnish and install an Ethernet Video Encoder at designated Transmitter Sites and Combination Repeater/Transmitter Sites as shown on the plans and as detailed in accordance with the following requirements. Use the same manufacturer and model for each Ethernet Video Encoder.

- 1. General Requirements.** Provide only equipment that is new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications. Provide an Ethernet Video Encoder that is fully compatible with existing Ethernet Video Encoders, existing Ethernet Video Decoders, existing ATM Video Encoders, existing ATM Video Decoders, and existing Closed Circuit Television (CCTV) control software. Provide all software, power supplies, and any other equipment or firmware that is associated with the operation of the Ethernet Video Encoder units.
- 2. Ethernet Port Configuration.** Provide an Ethernet Video Encoder with one Ethernet port that has the following features:
 - 10/100Base-TX
 - RJ-45 female connector
 - Automatic and user-selectable speed setting
 - Automatic and user-selectable half/full duplex setting
 - Dynamic Host Configuration Protocol (DHCP) automatic Internet Protocol (IP) address configuration
 - Static IP address configuration
 - LED link status indicator
 - LED activity status indicator
 - LED 10/100 status indicator
- 3. Video Encoding Capabilities.** Provide an Ethernet Video Encoder that has the following video encoding capabilities:
 - One video encoder channel
 - Encodes National Television System Committee (NTSC) Electronic Industries Alliance (EIA) RS-170A 1 volt peak-to-peak amplitude composite video signals
 - Encodes MPEG-2 4:2:0 Main Profile at Main Level (MP@ML) and Simple Profile at Main Level (SP@ML)
 - Composite video input with BNC connector
 - MPEG-2 transport streams over unicast and multicast User Datagram Protocol (UDP)/IP
 - IP over Ethernet transport
 - Encodes video streams at 1 to 15 Mbps, user-adjustable

- Encodes NTSC video at 29.97 fps, 525 lines
 - Adjustable Packet Identifier (PID) selection
 - Adjustable intrapicture and reference distance Group of Pictures (GOP)
 - Inputs composite and S-video signals
- 4. Additional Features.** Provide an Ethernet Video Encoder that has the following additional features:
- Low delay video encoding
 - Unicast and multicast MPEG-2 over IP
 - Supports static and Routing Information Protocol version 1 (RIP1) and version 2 (RIP2) routing
 - Serial Port for data transport
- 5. Standards.** Provide an Ethernet Video Encoder that is compliant with the following standards:
- ISO 13818-1 MPEG-2
 - ISO 13818-2 MPEG-2
 - ISO 13818-3 MPEG-2
- 6. Management.** Provide an Ethernet Video Encoder that provides the following management capabilities:
- Web browser/Hyper Text Transport Protocol (HTTP) configuration and management
 - Telnet configuration and management
 - Serial management console port
 - Allow multiple simultaneous management sessions or automatically terminate existing session when a new session is requested
 - Remotely upgradeable firmware
 - Simple Network Management Protocol (SNMP) version 2 device status, diagnostic, and alarm monitoring and remote configuration
 - RFC-1213-compliant Management Information Base (MIB) files
 - Standard and device specific MIB2 files
 - Alarm and diagnostic information
- 7. Regulatory Approvals.** Provide an Ethernet Video Encoder that has been certified to the following regulatory standards:
- Product Safety: Underwriters Laboratories (UL) Standard 1950 or 60950
 - Electromagnetic Emissions: Federal Communications Commission (FCC) Part 15, Class A
- 8. Dimensions.** Provide an Ethernet Video Encoder that does not exceed the following maximums:

- 19 in. rack mountable: 2 rack units height
 - Depth: 13 in.
 - Weight: 10 lb.
- 9. Operating Power.** Provide an Ethernet Video Encoder that meets the following power specifications:
- 120 V AC
 - 60 Hz
 - 55 W maximum power consumption
- 10. Environmental.** Provide an Ethernet Video Encoder that is designed to operate in the following environmental conditions:
- 0°C to 70°C operating temperature range
 - -40°C to 85°C storage temperature range
 - 10% to 90% relative humidity (non-condensing)
- I. Ethernet Video Decoder.** Furnish and install an Ethernet Video Decoder at designated Decoder Sites as shown on the plans and as detailed in accordance with the following requirements. Use the same manufacturer and model for each Ethernet Video Decoder.
- 1. General Requirements.** Provide only equipment that is new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications. Provide an Ethernet Video Decoder that is fully compatible with existing Ethernet Video Decoders, existing Ethernet Video Encoders, existing ATM Video Decoders, existing ATM Video Encoders, and existing Closed Circuit Television (CCTV) control software. Provide all software, power supplies, and any other equipment or firmware that is associated with the operation of the Ethernet Video Decoder units.
- 2. Ethernet Port Configuration.** Provide an Ethernet Video Decoder with one Ethernet port that has the following features:
- 10/100Base-TX
 - RJ-45 female connector
 - Automatic and user-selectable speed setting
 - Automatic and user-selectable half/full duplex setting
 - Dynamic Host Configuration Protocol (DHCP) automatic Internet Protocol (IP) address configuration
 - Static IP address configuration
 - Light-emitting diode (LED) link status indicator
 - LED activity status indicator
 - LED 10/100 status indicator

- 3. Video Decoding Capabilities.** Provide an Ethernet Video Decoder that has the following video decoding capabilities:
- Two independent video Decoder channels
 - Generates two simultaneous National Television System Committee (NTSC) Electronic Industries Alliance (EIA) RS-170A 1 volt peak-to-peak amplitude composite video signals
 - Decodes MPEG-2 4:2:0 and 4:2:2 Main Profile at Main Level (MP@ML) and Simple Profile at Main Level (SP@ML)
 - Two composite video outputs with BNC connectors
 - MPEG-2 transport streams over unicast and multicast User Datagram Protocol (UDP)/IP
 - IP over Ethernet transport
 - Decodes video streams up to 20 Mbps, auto-detecting
 - Decodes NTSC video at 29.97 fps, 525 lines
 - Adjustable Packet Identifier (PID) selection
 - Adjustable intrapicture and reference distance Group of Pictures (GOP)
 - Outputs composite and S-video signals
- 4. Additional Features.** Provide an Ethernet Video Decoder that has the following additional features:
- Low delay video decoding
 - Liquid Crystal Display (LCD) for IP address and video decoding status
 - Unicast and multicast MPEG-2 over IP
 - Supports static and Routing Information Protocol version 1 (RIP1) and version 2 (RIP2) routing
 - Titling and text overlay capability
 - Serial Port for data transport
- 5. Standards.** Provide an Ethernet Video Decoder that is compliant with ISO-13818-3 MPEG-2
- 6. Management.** Provide an Ethernet Video Decoder that provides the following management capabilities:
- Web browser/Hyper Text Transport Protocol (HTTP) configuration and management
 - Telnet configuration and management
 - Serial management console port
 - Allow multiple simultaneous management sessions or automatically terminate existing session when a new session is requested
 - Remotely upgradeable firmware

- Simple Network Management Protocol (SNMP) version 2 device status, diagnostic, and alarm monitoring and remote configuration
 - RFC-1213-compliant Management Information Base (MIB) files
 - Standard and device specific MIB2 files
- 7. Regulatory Approvals.** Provide an Ethernet Video Decoder that has been certified to the following regulatory standards:
- Product Safety: Underwriters Laboratories (UL) Standard 1950 or 60950
 - Electromagnetic Emissions: Federal Communications Commission (FCC) Part 15, Class A
- 8. Dimensions.** Provide an Ethernet Video Decoder that does not exceed the following maximums:
- 19 in. rack mountable: 2 rack units height
 - Depth: 13 in.
 - Weight: 10 lb.
- 9. Operating Power.** Provide an Ethernet Video Decoder that meets the following power specifications:
- 120 V AC
 - 60 Hz
 - 55 W maximum power consumption
- 10. Environmental.** Provide an Ethernet Video Decoder that is designed to operate in the following environmental conditions:
- 0°C to 70°C operating temperature range
 - -40°C to 85°C storage temperature range
 - 10% to 90% relative humidity (non-condensing)
- J. Temporary Camera Pole.** Furnish and install a Temporary Camera Pole in accordance with Item 627 “Treated Timber Poles” at designated locations as shown on the plans and as detailed in accordance with this specification.

4. Construction Methods.

- A. General.** Provide equipment that utilizes the latest available techniques for design and construction with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

Design the equipment for ease of maintenance. Provide component parts that are readily accessible for inspection and maintenance. Provide test points that are for checking essential voltages and waveforms.

- B. Electronic Components.** Provide electronic components in accordance with Special Specification, “Electronic Components”.

C. Mechanical Components. Provide external screws, nuts and locking washers that are stainless steel; no self-tapping screws will be used.

Provide parts made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass.

Protect materials from fungus growth and moisture deterioration.

Separate dissimilar metals by an inert dielectric material.

5. Documentation Requirements. Provide 5 complete sets of operation and maintenance manuals. Include the following:

- Complete and accurate schematic diagrams.
- Complete installation procedures.
- Complete performance specifications (functional, electrical, mechanical and environmental) on the unit.
- Complete parts list including names of vendors for parts not identified by universal part number such as JEDEC, RETMA, or EIA.
- Pictorial of component layout on circuit board.
- Complete maintenance and trouble-shooting procedures.
- Complete stage-by-stage explanation of circuit theory and operation.

6. Testing Requirements. It is the policy of the Texas Department of Transportation to require performance testing of all materials and equipment not previously tested and approved. If technical data are not considered adequate for approval, samples may be requested for test by the Engineer. The contract period will not be extended for time loss or delays caused by testing prior to final Texas Department of Transportation approval of any items.

The equipment referenced to this specification is subject to Design Approval Tests and Factory Demonstration Tests at the equipment manufacturer's facility to determine conformance with all the specification requirements except that the Engineer may accept certification by an independent testing laboratory in lieu of the design Approval Tests, to verify that the Design Approval Tests have previously been satisfactorily completed. The Contractor must arrange for and conduct the tests in accordance with the specification requirements stated herein.

Unless otherwise specified, the Contractor is responsible for satisfying all inspection requirements prior to submission for the Texas Department of Transportation's inspection and acceptance. The Engineer reserves the right to have his/her representative witness all Design Approval Tests and Factory Demonstration Tests.

Compare the results of each test with the requirements specified herein. Failure to conform to the requirements of any test shall be counted as a defect, and equipment shall be subject

to rejection by the Engineer. Rejected equipment may be offered for retest provided all non-compliances have been corrected and retested by the Contractor and evidence thereof submitted to the Engineer.

7. **Warranty.** Guarantee that equipment furnished and installed for this project will perform according to the manufacturer's published specifications. Warrant equipment against defects and/or failure in design, materials and workmanship in accordance with the manufacturer's standard warranty. Assign to the Department all manufacturers' normal warranties or guarantees on all electronic, electrical, and mechanical equipment, materials, technical data, and products furnished for and installed on the project. Repair or replace defective equipment, at the manufacturer's option, during the warranty period at no cost to the Department. Provide equipment with 95% of the manufacturer's standard warranty remaining on the date that equipment invoices are submitted by the Contractor for payment. Any equipment with less than 95% of its warranty remaining will not be accepted by the Department.
8. **Experience Requirements.** Personnel involved in the installation and testing of the "Wireless Radio CCTV" must meet the following requirements:
 - Three years experience in the installation and testing of Wireless Radio CCTV's.
 - Two installed systems where Wireless Radio CCTV's, as described within these specifications, are installed and the systems have been in continuously satisfactory operation for at least 2 years. Submit photographs or other supporting documents as proof, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the systems.
 - One system with Wireless Radio CCTV's (which may be one of the two in the preceding paragraph) which the Contractor can arrange for demonstration to the Engineer and/or his representatives.
9. **Training.** Conduct a training class (minimum of 4 hours) for up to 10 representatives designated by Texas Department of Transportation on procedures of installation, operations, testing, maintenance and repair of all equipment specified within these specifications. Submit to the Engineer for approval 10 copies of the training material at least 30 days before the training begins. Conduct training within the local area unless otherwise authorized by the Engineer. Customize the training specifically for the TransGuide System. Videotape the entire training on VHS (1/2 in.) tapes and deliver to TransGuide for later use.

10. Measurement.

Wireless Radio CCTV Transmitter Site will be measured as each site furnished, installed, tested, and made fully operational in accordance with this specification and as shown on the plans.

Wireless Radio CCTV Repeater Site will be measured as each site furnished, installed, tested, and made fully operational in accordance with this specification and as shown on the plans.

Wireless Radio CCTV Combination Repeater/Transmitter Site will be measured as each site furnished, installed, tested, and made fully operational in accordance with this specification and as shown on the plans.

Wireless Radio CCTV Receiver Site will be measured as each site furnished, installed, tested, and made fully operational in accordance with this specification and as shown on the plans.

Wireless Radio CCTV Decoder Site will be measured as each site furnished, installed, tested, and made fully operational in accordance with this specification and as shown on the plans.

Wireless Radio CCTV Upgrade Existing Transmitter Site to Combination Repeater/Transmitter Site will be measured as each site furnished, installed, tested, and made fully operational in accordance with this specification and as shown on the plans.

- 11. Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Wireless Radio CCTV Transmitter Site”, “Wireless Radio CCTV Repeater Site”, “Wireless Radio CCTV Combination Repeater/Transmitter Site”, “Wireless Radio CCTV Receiver Site”, “Wireless Radio CCTV Decoder Site”, “Wireless Radio CCTV Upgrade Existing Transmitter Site to Combination Repeater/Transmitter Site”. This price is full compensation for equipment, cables and connectors; documentation and testing; and labor, materials, warranty, training and incidentals.

SPECIAL SPECIFICATION

6446

Single Mode Fiber Optic Video/Data Transceiver Equipment

1. **Description.** Furnish and install Single Mode Fiber Optic Video/Data Transceiver Equipment in designated cabinets in the field and at TransGuide as shown on the plans and as detailed in the Special Specifications.
2. **Material.**
 - A. **General Requirements.** Furnish, assemble, fabricate and install only items that are new, corrosion resistant and in strict accordance with the details shown on the plans and in the Specifications.
 - B. **Functional Requirements.** The video and duplex data transceiver consists of a transmitter and a receiver and provides the interface between the camera and video encoder over the optical fiber network. Provide a transceiver that is compatible with the camera (video/data), video encoder, and the optical fiber network.

The video fiber optic transmitter-receiver system provides a video link to transmit NTSC baseband video from the camera cabinet/Fiber hub to the TransGuide Operations Center. The video fiber optic transmitter-receiver provides a bidirectional data link between the camera cabinet/Fiber Hub and the TransGuide Operations Center.

The video fiber optic transceiver(receiver) detects the optical signal and converts it to NTSC baseband video and data.

Provide equipment that operates on an optical wavelength of 1310 nm and 1550 nm. Base the wavelength and spectral line width selections on both the transmitter and the receiver designs.

One video link (1 single mode fiber) will be required for each camera in the field, with each link meeting EIA-RS-250C short haul video requirements.

Provide video/data fiber optic transmitters and receivers from the same manufacturer.

C. Electrical/Optical Requirements.

Video In/Output Impedance.....	75 Ohm(unbalanced)
Video In/Output Level.....	1.0V p-p typ, 1.5V max.
Frequency Response.....	5 Hz to 8 MHz
Differential Gain (10-90% APL).....	<± 1% typ
Differential Phase (10-90% APL).....	<± 1 deg typ
Field Tilt.....	<0.5% max
Signal to Noise Ratio.....	67 dB (weighted)
FM Carrier Frequency.....	70 MHz
Data Rate.....	DC to 300 Kbs

Video In/Output Impedance.....	75 Ohm(unbalanced)
Bit Error Rate.....	10 to the -9
Wave length.....	1310/1550nm Laser
Fiber Type.....	Singlemode (8-10)/125 microns
Output Power w/ST.....	8 dBm
Receiver Sensitivity.....	-34 dBm
Optical Loss Budget.....	26 dBm
Operating Temperature.....	-25°C to +70°C
Operating Humidity.....	0 to 95% non-condensing

- a. **Receiver Gain Control.** Provide a device with a wide optical dynamic range that does not require optical attenuators. Provide a device that incorporates video input LED's in the transmitter and level/loss indicators in the receiver for quick visual indication of link operation.
- b. **Power Requirements.** Provide Transmitters and Receivers that operate from separate power supplies to be provided as part of this bid Item and do not draw more than 10 Watts of power each.

Provide equipment whose operation is not affected by the transient voltages, surges and sags normally experienced on commercial power lines. It is the Contractor's responsibility to check the local power service to determine if any special design is needed for the equipment. Include the extra cost, if required, in the bid of this Item.

- c. **Surge Protection.** Install appropriate Surge protectors in the CCTV equipment cabinet for the coaxial video cable connection to the camera.
- d. **Power Service Transients.** Provide equipment that meets the requirements of Sec. 2.1.6, "Transients, Power Service" of the NEMA Standard TS1-1989, or the latest revision.
- e. **Wiring.** Ensure that all wiring meets the requirements of the National Electrical Code. Cut all wires to proper length. Provide cable slack to facilitate removal and replacement of assemblies, panels, and modules. Do not double back any wire to take up slack. Neatly lace wires into cable with nylon lacing or plastic straps. Secure cables with clamps.
- f. **Transient Suppression.** Install diodes or other protective devices across the coils of all DC relays, solenoids, and holding coils to ensure transient suppression.
- g. **Power Service Protection.** Provide equipment that contains readily accessible, manually resettable or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.
- h. **Fail Safe Provision.** Design the equipment so that if it fails it will not cause the failure of any other unit of equipment.

D. Mechanical Requirements.

1. **Modular Design.** Provide equipment that is modular in design to allow major portions to be readily replaced in the field. Ensure that modules of unlike functions are mechanically keyed to prevent insertion into the wrong socket or connector.

Clearly identify all modules and assemblies with name, model number, serial number, and any other pertinent information required to facilitate equipment maintenance.

2. **Connectors and Harnesses.** Make all external connections by means of connectors. Key the connectors to preclude improper hookups. Color code or appropriately mark all wires to and from the connectors.

Use BNC type connectors for Video input and output.

Use ST connectors approved by Bellcore Specification for Optical input and output.

Provide connecting harness of appropriate length and terminated with mating connectors for interconnection with the video camera, video encoder and the fiber optic network.

3. **Housing.** Provide a transceiver installed in the field that is available as a standard serviceable stand-alone unit and mountable on a 19 in. rack (furnished by the Contractor).

Provide a transceiver in the Fiber Hub or TransGuide that is available as a standard serviceable stand-alone unit and mountable on a 19 in. rack (furnished by the Contractor). Provide power supply and all required cabling and mounting hardware as part of the item, with no direct payment.

- E. **Environmental Design Requirements.** Provide equipment that meets its specified requirements during and after subsection to any combination of the following requirements.

Ambient temperature range of -40°C to +74°C.

Relative humidity from 0% to 95% non-condensing.

3. Construction Methods.

- A. **General.** Provide equipment that is designed and constructed utilizing the latest available techniques with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

Design equipment for ease of maintenance. Ensure that all component parts are readily accessible for inspection and maintenance. Provide test points for checking essential voltages and waveforms.

- B. **Electronic Components.** Provide electronic components in accordance with Special Specification, "Electronic Components".

- C. **Mechanical Components.** Provide external screws, nuts, and washers that are stainless steel; no self-tapping screws will be used unless approved by the Engineer.

Provide parts made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum, or brass.

Protect all materials used in construction from fungus and moisture deterioration.

Separate dissimilar metals by an inert dielectric material.

4. **Warranty.** Guarantee that equipment furnished and installed for this project will perform according to the manufacturer's published specifications. Warrant equipment against defects and/or failure in design, materials and workmanship in accordance with the manufacturer's standard warranty. Assign to the Department all manufacturers' normal warranties or guarantees on all electronic, electrical, and mechanical equipment, materials, technical data, and products furnished for and installed on the project. Repair or replace defective equipment, at the manufacturer's option, during the warranty period at no cost to the Department. Provide equipment with 95% of the manufacturer's standard warranty remaining on the date that equipment invoices are submitted by the Contractor for payment. Any equipment with less than 95% of its warranty remaining will not be accepted by the Department.
5. **Documentation Requirements.** Provide five complete sets of operation and maintenance manuals, which include at a minimum the following:
 - Complete and accurate schematic diagrams.
 - Complete installation procedures.
 - Complete performance specifications (Functional, Electrical, mechanical, and environmental) on the unit.
 - Complete parts list including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA, of EIA.
 - Pictorial of components layout on circuit board. (Parts List)
 - Complete maintenance and trouble-shooting procedures.
 - Complete stage-by-stage explanation of operational theory and operation.
6. **Testing Requirements.**

- A. **General.** It is the policy of the Texas Department of Transportation to require performance testing of all materials and equipment not previously tested and approved. If technical data are not considered adequate for approval, samples may be requested for test by the Engineer. The contract period will not be extended for time loss or delays caused by testing prior to final Texas Department of Transportation approval of any items.

The equipment referenced to this specification is subject to Design Approval Tests and Factory Demonstration Tests at the equipment manufacturer's facility to determine conformance with all the specification requirements except that the Engineer may accept certification by an independent testing laboratory in lieu of the design Approval Tests, to verify that the Design Approval Tests have previously been satisfactorily completed. The Contractor must arrange for and conduct the tests in accordance with the specification requirements stated herein.

Unless otherwise specified, the Contractor is responsible for satisfying all inspection requirements prior to submission for the Texas Department of Transportation's inspection and acceptance. The Engineer reserves the right to have his/her representative witness all Design Approval Tests and Factory Demonstration Tests.

Compare the results of each test with the requirements specified herein. Failure to conform to the requirements of any test will be counted as a defect, and equipment will be subject to rejection by the Engineer. Rejected equipment may be offered for retest provided all non-compliances have been corrected and retested by the Contractor and evidence thereof submitted to the Engineer

Other equipment testing requirements:

1. **Vibration.** Provide equipment that shows no degradation of mechanical structure, soldered components, plug-in components, or satisfactory operation when subject to tests as defined in Sec. 2.2.5, "Vibration Test" of NEMA standard TS1-1989 or the latest revision.
2. **Subsystem Test.** Conduct a video transmission subsystem test. At a minimum, demonstrate all video signal receptions in the Transguide Operation Control Center. Conduct a signal to noise ratio (SNR) test on all video links. Ensure that the ratio, peak-to-peak (white to blanking) to RMS noise unweighted, measured in a 10 KHz to 5 MHz bandwidth, is better than 60 dB at 26 dB optical attenuation.

Ensure that the operator is able to have full and normal control of the camera during the test.

If subsystem tests fail because of any component(s) in the subsystem, correct or substitute the particular component(s) with other component(s) and repeat the tests.

Prepare and deliver to the Engineer prior to testing a report if a component has been modified as a result of the subsystem test failure.

7. **Training.** Conduct a training class (minimum of 40 hours) for up to 10 representatives designated by the Texas Department of Transportation on procedures of installation, operations, testing, maintenance and repair of all equipment specified within the specification. Submit to the Engineer for approval, 10 copies of the training material at least 30 days before the training begins. Conduct the training within the local area unless otherwise authorized by the Engineer.

Videotape the entire training on VHS (1/2 in.) tapes and provide the tapes to the Department for later use.

8. **Measurement.** This Item will be measured as each unit furnished, installed, made fully operational and tested in accordance with these Special Specifications or as directed by the Engineer.
9. **Payment.** The work performed and material furnished in accordance with this Item, and measured as provided under "Measurement" will be paid for at the unit price bid for "Single Mode Fiber Optic Video/Data Transceiver". This price will include all equipment described under this Item with all cables and connectors, all documentation and testing; and will

include the cost of furnishing all labor, materials, training, warranty and equipment necessary to complete the work.

SPECIAL SPECIFICATION

6441

CCTV Field Equipment

- 1. Description.** Provide and install Closed Circuit Television (CCTV) Field Equipment in designated field locations and equipment cabinets as shown on the plans, as detailed in the Special Specifications and as directed by the Engineer.
- 2. Materials.**
 - A. General Requirements.** Provide, assemble, fabricate and install materials that are new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications.
 - 1.** Provide CCTV Field Equipment that is fully compatible with software as specified in the Special Specification, "Software System Interface" in order to interface with the existing equipment and software located in the TransGuide Operations Control Center.
 - 2.** CCTV Field Equipment includes, but is not limited to, the following:
 - a.** Color video camera units.
 - b.** Camera lenses, filters, control circuits and accessories.
 - c.** Camera housings.
 - d.** Medium duty pan and tilt units.
 - e.** Camera control receivers.
 - f.** Video and camera control and power cable harnesses, connectors and coax.
 - g.** Source ID generator.
 - B. Functional Requirements.** Provide CCTV cameras that meet the following criteria:
 - 1.** 525 lines per frame, interlaced 2:1, per EIA-170A Standard.
 - 2.** No discernible interlace jitter or line pairing on the viewing monitor.
 - 3.** Frame frequency of 30 frames per second.
 - 4.** Width to height aspect ratio of 4:3.
 - 5.** System limiting resolution that conforms to FCC regulations for broadcast signals.

6. System capable of providing clear, low-bloom and low-lag video pictures under all conditions from bright sunlight to nighttime scene illumination of 0.85 foot-candle (fc) with full video AGC (Automatic Gain Control) off.
7. Color quality that is maintained by a continuous through the lens automatic white balance for color temperatures from 2850K to greater than 5100K with less than 10 IRE units unbalance.
8. Operational in all weather conditions and able to withstand a wind load of 80 mph without permanent damage to mechanical and electrical equipment.
9. Equipment that is identical at each field location and completely interchangeable.

C. Electrical and Mechanical Requirements.

1. **Video Camera Unit.** Provide color video cameras that are of solid state design, that meet the following requirements:
 - a. **Digital Signal Processing (DSP):**
 - (1) For digital zoom.
 - (2) For auto/manual long-term integration (exposure) control, with built-in frame buffer.
 - (3) For auto-focus.
 - (4) For built-in ID generator, with white letters and black outline.
 - b. **Image Pickup Device.** 1/4 in. single chip interline transfer solid state color matrix CCD microlens sensor.
 - c. **Pickup Device Blemishes.** No blemishes for any iris opening producing any signal level between 7.5 and 100 IRE, when viewing a uniform white field.
 - d. **Sensitivity.** Maintain full p-p video with 0.1 fc., 3200°K incandescent illumination on the image device face plate with AGC off.
 - e. **Resolution.** >350 lines vertical and >460 lines horizontal, measured per EIA-170A Standard.
 - f. **Over Exposure Protection.** No permanent damage to the camera when pointed directly at strong light sources, including the sun, for brief periods of time.
 - g. **Encoded NTSC Video Signal Format.** EIA-170A Standard, video output 1 Volt p-p composite. Provide up to 16 dB AGC.
 - h. **Output Impedance.** 75 Ohms \pm 5%.
 - i. **Aspect Ratio.** 4:3.
 - j. **Geometric Distortion.** Zero.

- k. Signal to Noise Ratio (AGC Off)** 55 dB Minimum (weighted at 4.5 MHz).
 - (1) Provide a sensor having a minimum of 768 (H) X 493(V) pixels.
- l. Electronic Shutter Speed.** Capable of being selectable from a remote location with the use of software.
- 2. Camera Accessories.** Provide an integral lens assembly for each camera with the following features:
 - a.** An f/1.6 or better glass multi-coated zoom lens with variable focal length from 3.9 mm to 85.8 mm.
 - b.** Motorized iris control with manual override with each lens.
 - c.** Lenses with capabilities for remote control of the zoom, focus and iris operations. Mechanical or electrical means provided to protect the motors from overrunning in extreme positions. Lens and controller system capable of both auto iris and remote manual iris operation. Capabilities of lens for the zoom and focus. Motorized iris as opposed to auto iris type, for system control capability.
- 3. Camera Housing.**
 - a.** Furnish and install an environmentally resistant, tamper proof pressurized housing with 5 pounds psi dry Nitrogen with Schrader purge fitting and 20 psi relief valve for each camera.
 - b.** With the exception of the viewing window, provide enclosure that is constructed from 6061-T6 standard aluminum tubing with a wall thickness of 0.20 in. \pm 0.03 in. Mount internal components to a rail assembly. Use a copper plated spring-steel ring to ensure electrical bonding of the rail assembly and components to the camera housing. Finish housing exterior using pre-treatment with a conversion coating and baked enamel paint.
 - c.** Properly label internal wiring. Use a gas-tight connector at the rear plate of the housing. Seal wiring to the connector with silicon or potting compound.
 - d.** Maintain internal humidity of housing less than 10% when sealed and pressurized. Place desiccant packs securely inside the housing to absorb any residual moisture and maintain the internal humidity at 10% or less.
 - e.** Construct viewing window in such a way that unrestricted camera views can be obtained at all camera and lens positions.
 - f.** Provide a sun shield to shield the entire housing from direct sunlight. Construct the shield in such a way as to allow the free passage of air between the housing and the shield, but not form a "sail" to place an excessive load on the pan/tilt unit in high winds.
 - g.** Provide entry at the rear and/or bottom for cables and harness, with gaskets at the entry points to prevent moisture entry.

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connect to the communications equipment interface. Provide the RS-232 to RS-422 self-powered converter, integral to the video communication junction box.

- 8. Power Input.** Provide 115 VAC \pm 10%, 60 Hz \pm 3 Hz, 50 Watts Maximum.
- 9. Connectors.** Provide and install connectors that are compatible with the communications equipment interface. Use an AMP type connector and pin assignments that are compatible with existing installations. Use connectors for connections at the pan/tilt mechanism, and make connections through a pigtail with connector on it, coming out of the bottom center of the pan/tilt unit. Use this connector to make connections to the transmission cables. Supply all mating connectors. Provide all connector pins and mating connectors that are plated to ensure good electrical connection and resistance to corrosion. Use pressure tight multi-conductor MS-type cable connectors for camera connections.
- 10. Source ID Generator.** Use a built-in ID Generator to insert camera ID over each of the camera-generated videos.
 - a. Submit a list of proposed camera identification text to the Engineer for approval before the ID is programmed.
 - b. Once approved, ensure that the programmed ID is automatically displayed with its associated video signal.
- 11. Video Communication Junction Box.** Install video communication junction box in the CCTV equipment cabinet or in the fiber hub as shown on the plans and as directed by the Engineer. Ensure that it meets the following criteria:
 - a. Contains all the lightning protection devices for data and video.
 - b. Grounded to earth ground.
 - c. Has connectors for all inputs and outputs for data and video and additional ports for testing video and communications. Use the external connectors for testing and for connections to communication devices.
- 12. Surge Protection.** Ensure that camera installation meets the following requirements:
 - a. Pole mounting adapter – Electrically bonded to pole.
 - b. Pan/tilt mechanism – Electrically bonded to adapter.
 - c. Camera housing – Electrically bonded to pan/tilt unit.
 - d. Power and Control Cable Surge Protector – Protected by the appropriate surge protector as specified in Special Specification, “CCTV Equipment Cabinets”.
- 13. Power Requirements.** Ensure that the CCTV field equipment meets all of its specified requirements when the input power is 115 VAC \pm 10%, 60 Hz \pm 3 Hz, and that maximum power required does not exceed 350 watts.

Ensure that equipment operations is not affected by the transient voltages, surges and sags normally experienced on commercial power lines. Check the local power service to determine if any special design is necessary for the equipment. Any extra cost is included in this item.

- 14. Primary Input Power Interruption.** Ensure that the CCTV field equipment meets all the requirements in Section 2.1.4., “Power Interruption” of the National Electrical Manufacturers Association (NEMA) Standard TS1 for Traffic Control System.
- 15. Power Service Transients.** Ensure that the CCTV field equipment meets the requirements for Section 2.1.6., “Transients, Power Service” of the NEMA Standard TS1.
- 16. Wiring.** Ensure that all wiring meets the requirements of the National Electrical Code. Cut all wires to the proper length prior to assembly. Never double-back wire to take up slack. Neatly lace wires into cable with nylon lacing or plastic straps. Secure cables with clamps. Provide service loops at all connections.

Provide coaxial cable between the camera and the communications equipment interface that is of the RG-59 type with a stranded center conductor with 100% shield coverage, with a cellular polyethylene dielectric.
- 17. Transient Suppression.** Provide DC relays, solenoids and holding coils that have diodes or other protective devices across the coils for transient suppression.
- 18. Power Service Protection.** Ensure that equipment contains readily accessible, manually reset able or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection. Provide circuit breakers or fuses sized such that no wire, component, connector, PC board or assembly is subjected to sustained current in excess of their respective design limits upon failure of any single circuit element or wiring.
- 19. Fail Safe Provision.** Ensure that the equipment is designed such that any failures will not cause the failure of any other unit of equipment.
- 20. Modular Design.** Provide CCTV equipment that is modular in design, to allow major portions to be readily replaced in the field. Clearly identify modules and assemblies with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance.
- 21. Connectors and Harnesses.** Make all external connections by means of connectors that are keyed to preclude improper hookups. Color-code and/or appropriately mark all wires to and from the connectors. Provide connecting harnesses of appropriate length and terminated with matching connectors for interconnection with the communications system equipment. Ensure that all pins and mating connectors are plated to improve conductivity and are corrosion resistant. Ensure that connectors utilizing solder type connections have each soldered connection covered by a piece of heat shrink tubing securely shrunk to protect the connection.

D. Environmental Design Requirements. Ensure that equipment meets all its specified requirements during and after being subjected to any combination of the following conditions:

1. Ambient temperature range of 0°F to 140°F.
2. Temperature shock not to exceed 30°F per hour, during which the relative humidity does not exceed 95%.
3. Relative humidity range not to exceed 95% over the temperature range of 40°F to 110°F.
4. Moisture condensation on all exterior surfaces caused by temperature changes.
5. Camera and environmental housing assembly performs to stated specifications over an ambient temperature range of -35°F to +130°F in direct sunlight and a humidity range of 0% to 100% condensing. Ensure that the camera will operate without sustaining damage over a temperature range of -35°F to +140°F.

3. Construction.

A. General. To maximize standardization and commonality, utilize the latest available techniques in equipment design and construction, with the minimum number of parts, subassemblies, circuits, cards, and modules. Design equipment for ease of maintenance. Ensure that all component parts are readily accessible for inspection and maintenance. Provide test points for checking essential voltages and waveforms.

B. Electronic Components. Ensure that all electronic components comply with Special Specification, "Electronic Components".

C. Mechanical Components. Ensure that all external screws, nuts and locking washers are stainless steel. Do not use self-tapping screws unless specifically approved by the Engineer.

1. Provide parts that are made of corrosion resistant material such as plastic, stainless steel, anodized aluminum or brass.
2. Protect all materials used in construction from fungus growth and moisture deterioration.
3. Separate dissimilar metals by an inert dielectric material.

4. Documentation Requirements. Provide 5 complete sets of operation and maintenance manuals that include the following:

- A.** Complete and accurate schematic diagrams.
- B.** Complete installation procedures.
- C.** Complete performance specifications (Functional, electrical, mechanical and environmental) on the unit.

- D. Complete parts list including names of vendors for parts not identified by universal part number such as JEDEC, RETMA, or EIA.
- E. Pictorial of component layout on circuit board.
- F. Complete maintenance and trouble-shooting procedures.
- G. Complete stage-by-stage explanation of circuit theory and operation.

5. Testing Requirements.

- A. As per TxDOT policy, performance testing is to be done on all materials and equipment not previously tested and approved. If technical data are not considered adequate for approval, samples may be requested for test by the Engineer. The contract period will not be extended for time loss or delays caused by testing prior to final TxDOT approval of any items.
- B. Equipment referenced to this specification is subject to Design Approval Tests and Factory Demonstration Tests at the equipment manufacturer's facility, to determine conformance with all the specification requirements. The Engineer may accept certification by an independent testing laboratory in lieu of the design Approval Tests, to verify that the Design Approval Tests have previously been satisfactorily completed. Arrange for, and conduct the tests, in accordance with the specification requirements stated herein.
- C. Take responsibility for satisfying all inspection requirements prior to submission for TxDOT's inspection and acceptance. The Engineer reserves the right to have his/her representative witness all Design Approval Tests and Factory Demonstration Tests.
- D. Results of each test will be compared with the requirements specified herein. Failure to conform to the requirements of any test will be counted as a defect, and equipment will be subject to rejection by the Engineer. Rejected equipment may be offered for retest, provided all non-compliances have been corrected and retested and evidence thereof submitted to the Engineer.

- 6. Warranty.** Guarantee that equipment furnished and installed for this project performs according to the manufacturer's published specifications. Warrant the equipment against defects and/or failure in design, materials, and workmanship in accordance with the manufacturer's standard warranty. Assign, to the Department, all manufacturers' normal warranties or guarantees on all such electronic, electrical, and mechanical equipment, materials, technical data, and products furnished for and installed on the project. Repair or replace, at the manufacturer's option, defective equipment, during the warranty period at no cost to the Department. Ensure that all equipment has no less than 95% of the manufacturer's standard warranty remaining, on the date that equipment invoices are submitted for payment. Any equipment with less than 95% of its warranty remaining will not be accepted by the Department.

- 7. Experience Requirements.** Contractor involved in the installation and testing of video equipment as described within these specifications must meet the following requirements:

- A. Three years experience in the installation and testing of video equipment as described within these specifications.
 - B. Two installed systems where video equipment, as described within these specifications, is installed and the system has been in continuously satisfactory operation for at least two years. Submit as proof, photographs or other supporting documents, and the names addresses and phone numbers of the operating personnel who can be contacted regarding the system.
 - C. One video system (which may be one of the two in the preceding paragraph) that can be arranged for demonstration to the Engineer and/or his/her representatives.
8. **Training.** Conduct a training class (minimum of 40 hours) for up to 10 representatives designated by TxDOT on procedures of installation, operations, testing, maintenance and repair of all equipment specified within these specifications. Submit to the Engineer for approval, 10 copies of the training material at least 30 days before the training begins. Conduct training within the local area unless otherwise authorized by the Engineer. Customize the training specifically for the TransGuide System. Video tape the entire training session on VHS (1/2 in.) tapes, and deliver to TransGuide for later use.
9. **Measurement.** Measure this item as each unit furnished, installed, made fully operational and tested in accordance with these specifications or as directed by the Engineer.
10. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit bid price for each “CCTV Field Equipment”. This price includes all equipment with all cables and connectors; the cost of furnishing all labor, materials, training, software, equipment, and incidentals.

SPECIAL SPECIFICATION

6431

Dual OC-3 ATM MPEG-2 Encoder

1. **Description.** Furnish, install, and make fully operational an Asynchronous Transfer Mode (ATM) Video Encoder at designated locations as shown on the plans and as detailed in accordance with this specification. Use the same manufacturer and model for each ATM Video Encoder.
2. **Materials.** Provide an ATM Video Encoder, software, power supplies, and any other equipment or firmware that is associated with the operation of these units. Provide an ATM Video Encoder unit that meets the following requirements.
 - A. **General Requirements.** Provide only equipment that is new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications. Provide an ATM Video Encoder that is fully compatible with existing ATM Video Encoders, existing ATM Video Decoders, and existing Closed Circuit Television (CCTV) control software.
 - B. **Ethernet Port Configuration.** Provide an ATM Video Encoder with one Ethernet port that has the following features:
 - 10/100Base-TX
 - RJ-45 female connector
 - Automatic and user-selectable speed setting
 - Automatic and user-selectable half/full duplex setting
 - Dynamic Host Configuration Protocol (DHCP) automatic Internet Protocol (IP) address configuration
 - Static IP address configuration
 - Light-emitting diode (LED) link status indicator
 - LED activity status indicator
 - LED 10/100 status indicator
 - C. **ATM Interface Requirements.** Provide an ATM Video Encoder that has the following ATM interface features:
 - Dual OC-3c ATM interfaces
 - Daisy-chainable ATM interfaces that automatically pass non-empty ATM cells inbound on one port outbound on the other port
 - Synchronous Optical Network (SONET) OC-3c/SDH STM-1 ports
 - ATM User Network Interface (UNI); STS-3c signaling

- 155.52 Mbps data rate for each port
- For single-mode units (as shown on the plans):
 - 1310 nm media wavelength
 - -8 to -15 dBm transmit optical power
 - -33 dBm minimum receive sensitivity
 - Operates over 0 to 18 dB path attenuation
 - Drives up to 15 km of 8.3/125 μm single-mode fiber optic cable at 155.52 Mbps
 - LC single-mode fiber optic duplex female connector
- For multimode units (as shown on the plans):
 - 1310 nm media wavelength
 - -14 to -20 dBm transmit optical power
 - -33 dBm minimum receive sensitivity
 - Operates over 0 to 13 dB path attenuation
 - Drives up to 2 km of 62.5/125 μm multimode fiber optic cable at 155.52 Mbps
 - LC multimode fiber optic duplex female connector

D. Video Encoding Capabilities. Provide an ATM Video Encoder that has the following video encoding capabilities:

- One or two (single or dual) independent video encoder channels (as shown on the plans)
- Encodes National Television System Committee (NTSC) Electronic Industries Alliance (EIA) RS-170A 1 volt peak-to-peak amplitude composite video signals
- Encodes MPEG-2 4:2:0 Main Profile at Main Level (MP@ML) and Simple Profile at Main Level (SP@ML)
- Composite video input with BNC connector
- Native ATM Adaptation Layer 5 (AAL5) transport using two MPEG-2 Transport Stream (TS) packets per AAL5 PDU
- IP over Ethernet transport
- RFC-1483/2684 Logical Link Control/Standard Network Access Protocol (LLC/SNAP) routed encapsulation IP over ATM (IPOA) AAL5 transport
- Encodes video streams at 1 to 15 Mbps, user-adjustable
- Encodes NTSC video at 29.97 fps, 525 lines
- Adjustable Packet Identifier (PID) selection
- Adjustable intrapicture and reference distance Group of Pictures (GOP)
- Inputs composite and S-video signals

E. Additional Features. Provide an ATM Video Encoder that has the following additional features:

- Operates over Unspecified Bit Rate (UBR) and Constant Bit Rate (CBR) traffic contracts
- Low delay video encoding
- Liquid Crystal Display (LCD) for IP address and video encoding status
- Unicast and multicast MPEG-2 over IP
- Supports static and Routing Information Protocol version 1 (RIP1) and version 2 (RIP2) routing
- Supports IP pass-through between the Ethernet and ATM ports using RFC-1483/2684 LLC/SNAP routed encapsulation IPOA AAL5 transport

F. Standards. Provide an ATM Video Encoder that is compliant with the following standards:

- ISO 13818-1, -2, -3 MPEG-2
- ATM Forum UNI 3.0/3.1, AAL5
- RFC-1483/2684 LLC/SNAP routed encapsulation IPOA AAL5 transport

G. Management. Provide an ATM Video Encoder that provides the following management capabilities:

- Web browser/Hyper Text Transport Protocol (HTTP) configuration and management
- Telnet configuration and management
- Serial management console port
- Allow multiple simultaneous management sessions or automatically terminate existing session when a new session is requested
- Remotely upgradeable firmware
- Simple Network Management Protocol (SNMP) version 2 device status, diagnostic, and alarm monitoring and remote configuration
- RFC-1213-compliant Management Information Base (MIB) files
- Standard and device specific MIB2 files
- Alarm and diagnostic information

H. Regulatory Approvals. Provide an ATM Video Encoder that has been certified to the following regulatory standards:

- Product Safety: Underwriters Laboratories (UL) Standard 1950 or 60950
- Electromagnetic Emissions: Federal Communications Commission (FCC) Part 15, Class A

I. Dimensions. Provide an ATM Video Encoder that does not exceed the following maximums:

- 19 in. rack mountable: 2 rack units height
- Depth: 13 in.

- Weight: 10 lb.

J. Operating Power. Provide an ATM Video Encoder that meets the following power specifications:

- 120 V AC
- 60 Hz
- 55 W maximum power consumption

K. Environmental. Provide an ATM Video Encoder that is designed to operate in the following environmental conditions:

- 0°C to 70°C operating temperature range
- -40°C to 85°C storage temperature range
- 10% to 90% relative humidity (non-condensing)

3. Construction.

A. General. Provide equipment that utilizes the latest available techniques for design and construction with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

Design the equipment for ease of maintenance. Provide component parts that are readily accessible for inspection and maintenance. Provide test points that are for checking essential voltages and waveforms.

B. Electronic Components. Provide electronic components in accordance with Special Specification, “Electronic Components”.

C. Mechanical Components. Provide external screws, nuts and locking washers that are stainless steel; no self-tapping screws will be used.

Provide parts made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass.

Protect materials from fungus growth and moisture deterioration.

Separate dissimilar metals by an inert dielectric material.

4. Documentation Requirements. Provide 5 complete sets of operation and maintenance manuals. Include the following:

- Complete and accurate schematic diagrams.
- Complete installation procedures.
- Complete performance specifications (functional, electrical, mechanical and environmental) on the unit.
- Complete parts list including names of vendors for parts not identified by universal part number such as JEDEC, RETMA, or EIA.
- Pictorial of component layout on circuit board.
- Complete maintenance and trouble-shooting procedures.

- Complete stage-by-stage explanation of circuit theory and operation.

- 5. Testing Requirements.** It is the policy of the Texas Department of Transportation to require performance testing of all materials and equipment not previously tested and approved. If technical data are not considered adequate for approval, samples may be requested for test by the Engineer. The contract period will not be extended for time loss or delays caused by testing prior to final Texas Department of Transportation approval of any items.

The equipment referenced to this specification is subject to Design Approval Tests and Factory Demonstration Tests at the equipment manufacturer's facility to determine conformance with all the specification requirements except that the Engineer may accept certification by an independent testing laboratory in lieu of the design Approval Tests, to verify that the Design Approval Tests have previously been satisfactorily completed. The Contractor must arrange for and conduct the tests in accordance with the specification requirements stated herein.

Unless otherwise specified, the Contractor is responsible for satisfying all inspection requirements prior to submission for the Texas Department of Transportation's inspection and acceptance. The Engineer reserves the right to have his/her representative witness all Design Approval Tests and Factory Demonstration Tests.

Compare the results of each test with the requirements specified herein. Failure to conform to the requirements of any test shall be counted as a defect, and equipment shall be subject to rejection by the Engineer. Rejected equipment may be offered for retest provided all non-compliances have been corrected and retested by the Contractor and evidence thereof submitted to the Engineer.

- 6. Warranty.** Guarantee that equipment furnished and installed for this project will perform according to the manufacturer's published specifications. Warrant equipment against defects and/or failure in design, materials and workmanship in accordance with the manufacturer's standard warranty. Assign to the Department all manufacturers' normal warranties or guarantees on all electronic, electrical, and mechanical equipment, materials, technical data, and products furnished for and installed on the project. Repair or replace defective equipment, at the manufacturer's option, during the warranty period at no cost to the Department. Provide equipment with 95% of the manufacturer's standard warranty remaining on the date that equipment invoices are submitted by the Contractor for payment. Any equipment with less than 95% of its warranty remaining will not be accepted by the Department.
- 7. Experience Requirements.** Personnel involved in the installation and testing of the "Dual OC-3 ATM MPEG-2 Encoder" must meet the following requirements:
 - Three years experience in the installation and testing of ATM Video Encoders.
 - Two installed systems where ATM Video Encoders, as described within these specifications, are installed and the systems have been in continuously satisfactory operation for at least 2 years. Submit photographs or other supporting documents as proof, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the systems.

- One system with ATM Video Encoders (which may be one of the two in the preceding paragraph) which the Contractor can arrange for demonstration to the Engineer and/or his representatives.
- 8. Training.** Conduct a training class (minimum of 4 hours) for up to 10 representatives designated by Texas Department of Transportation on procedures of installation, operations, testing, maintenance and repair of all equipment specified within these specifications. Submit to the Engineer for approval 10 copies of the training material at least 30 days before the training begins. Conduct training within the local area unless otherwise authorized by the Engineer. Customize the training specifically for the TransGuide System. Videotape the entire training on VHS (1/2 in.) tapes and deliver to TransGuide for later use.
- 9. Measurement.** This Item will be measured as each unit furnished, installed, and tested.
- 10. Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Dual OC-3 ATM MPEG-2 Encoder”. This price is for compensation for equipment, cables and connectors; documentation and testing; and labor, materials, warranty, training and incidentals.

SPECIAL SPECIFICATION

6440

Dual OC-3 ATM MPEG-2 Decoder

1. **Description.** Furnish, install, and make fully operational an Asynchronous Transfer Mode (ATM) Video Decoder at designated locations as shown on the plans and as detailed in accordance with this specification. Use the same manufacturer and model for each ATM Video Decoder.
2. **Materials.** Provide an ATM Video Decoder, software, power supplies, and any other equipment or firmware that is associated with the operation of these units. Provide an ATM Video Decoder unit that meets the following requirements.
 - A. **General Requirements.** Provide only equipment that is new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications. Provide an ATM Video Decoder that is fully compatible with existing ATM Video Decoders, existing ATM Video Encoders, and existing Closed Circuit Television (CCTV) control software.
 - B. **Ethernet Port Configuration.** Provide an ATM Video Decoder with one Ethernet port that has the following features:
 - 10/100Base-TX
 - RJ-45 female connector
 - Automatic and user-selectable speed setting
 - Automatic and user-selectable half/full duplex setting
 - Dynamic Host Configuration Protocol (DHCP) automatic Internet Protocol (IP) address configuration
 - Static IP address configuration
 - Light-emitting diode (LED) link status indicator
 - LED activity status indicator
 - LED 10/100 status indicator
 - C. **ATM Interface Requirements.** Provide an ATM Video Decoder that has the following ATM interface features:
 - Dual OC-3 multimode ATM interfaces
 - Daisy-chainable ATM interfaces that automatically pass non-empty ATM cells inbound on one port outbound on the other port
 - Synchronous Optical Network (SONET) OC-3c/SDH STM-1 ports
 - ATM User Network Interface (UNI); STS-3c signaling

- 155.52 Mbps data rate for each port
- 1310 nm media wavelength
- -14 to -20 dBm transmit optical power
- -33 dBm minimum receive sensitivity
- Operates over 0 to 13 dB path attenuation
- Drives up to 2 km of 62.5/125 μ m multimode fiber optic cable at 155.52 Mbps
- LC multimode fiber optic duplex female connector

D. Video Decoding Capabilities. Provide an ATM Video Decoder that has the following video decoding capabilities:

- Two independent video Decoder channels
- Generates two simultaneous National Television System Committee (NTSC) Electronic Industries Alliance (EIA) RS-170A 1 volt peak-to-peak amplitude composite video signals
- Decodes MPEG-2 4:2:0 Main Profile at Main Level (MP@ML) and Simple Profile at Main Level (SP@ML)
- Two composite video outputs with BNC connectors
- Native ATM Adaptation Layer 5 (AAL5) transport using two MPEG-2 Transport Stream (TS) packets per AAL5 PDU
- IP over Ethernet transport
- RFC-1483/2684 Logical Link Control/Standard Network Access Protocol (LLC/SNAP) routed encapsulation IP over ATM (IPOA) AAL5 transport
- Decodes video streams up to 20 Mbps, auto-detecting
- Decodes NTSC video at 29.97 fps, 525 lines
- Adjustable Packet Identifier (PID) selection
- Adjustable intrapicture and reference distance Group of Pictures (GOP)
- Outputs composite and S-video signals

E. Additional Features. Provide an ATM Video Decoder that has the following additional features:

- Operates over Unspecified Bit Rate (UBR) and Constant Bit Rate (CBR) traffic contracts
- Low delay video decoding
- Liquid Crystal Display (LCD) for IP address and video decoding status
- Unicast and multicast MPEG-2 over IP
- Supports static and Routing Information Protocol version 1 (RIP1) and version 2 (RIP2) routing
- Supports IP pass-through between the Ethernet and ATM ports using RFC-1483/2684 LLC/SNAP routed encapsulation IPOA AAL5 transport

- Titling and text overlay capability
- F. Standards.** Provide an ATM Video Decoder that is compliant with the following standards:
- ISO 13818-1, -2, -3 MPEG-2
 - ATM Forum UNI 3.0/3.1, AAL5
 - RFC-1483/2684 LLC/SNAP routed encapsulation IPOA AAL5 transport
- G. Management.** Provide an ATM Video Decoder that provides the following management capabilities:
- Web browser/Hyper Text Transport Protocol (HTTP) configuration and management
 - Telnet configuration and management
 - Serial management console port
 - Allow multiple simultaneous management sessions or automatically terminate existing session when a new session is requested
 - Remotely upgradeable firmware
 - Simple Network Management Protocol (SNMP) version 2 device status, diagnostic, and alarm monitoring and remote configuration
 - RFC-1213-compliant Management Information Base (MIB) files
 - Standard and device specific MIB2 files
- H. Regulatory Approvals.** Provide an ATM Video Decoder that has been certified to the following regulatory standards:
- Product Safety: Underwriters Laboratories (UL) Standard 1950 or 60950
 - Electromagnetic Emissions: Federal Communications Commission (FCC) Part 15, Class A
- I. Dimensions.** Provide an ATM Video Decoder that does not exceed the following maximums:
- 19 in. rack mountable: 2 rack units height
 - Depth: 13 in.
 - Weight: 10 lb.
- J. Operating Power.** Provide an ATM Video Decoder that meets the following power specifications:
- 120 V AC
 - 60 Hz
 - 55 W maximum power consumption
- K. Environmental.** Provide an ATM Video Decoder that is designed to operate in the following environmental conditions:

- 0°C to 70°C operating temperature range
- -40°C to 85°C storage temperature range
- 10% to 90% relative humidity (non-condensing)

3. Construction.

- A. General.** Provide equipment that utilizes the latest available techniques for design and construction with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

Design the equipment for ease of maintenance. Provide component parts that are readily accessible for inspection and maintenance. Provide test points that are for checking essential voltages and waveforms.

- B. Electronic Components.** Provide electronic components in accordance with Special Specification, "Electronic Components".

- C. Mechanical Components.** Provide external screws, nuts and locking washers that are stainless steel; no self-tapping screws will be used.

Provide parts made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass.

Protect materials from fungus growth and moisture deterioration.

Separate dissimilar metals by an inert dielectric material.

- 4. Documentation Requirements.** Provide 5 complete sets of operation and maintenance manuals. Include the following:

- Complete and accurate schematic diagrams.
- Complete installation procedures.
- Complete performance specifications (functional, electrical, mechanical and environmental) on the unit.
- Complete parts list including names of vendors for parts not identified by universal part number such as JEDEC, RETMA, or EIA.
- Pictorial of component layout on circuit board.
- Complete maintenance and trouble-shooting procedures.
- Complete stage-by-stage explanation of circuit theory and operation.

- 5. Testing Requirements.** It is the policy of the Texas Department of Transportation to require performance testing of all materials and equipment not previously tested and approved. If technical data are not considered adequate for approval, samples may be requested for test by the Engineer. The contract period will not be extended for time loss or delays caused by testing prior to final Texas Department of Transportation approval of any items.

The equipment referenced to this specification is subject to Design Approval Tests and Factory Demonstration Tests at the equipment manufacturer's facility to determine

conformance with all the specification requirements except that the Engineer may accept certification by an independent testing laboratory in lieu of the design Approval Tests, to verify that the Design Approval Tests have previously been satisfactorily completed. The Contractor must arrange for and conduct the tests in accordance with the specification requirements stated herein.

Unless otherwise specified, the Contractor is responsible for satisfying all inspection requirements prior to submission for the Texas Department of Transportation's inspection and acceptance. The Engineer reserves the right to have his/her representative witness all Design Approval Tests and Factory Demonstration Tests.

Compare the results of each test with the requirements specified herein. Failure to conform to the requirements of any test shall be counted as a defect, and equipment shall be subject to rejection by the Engineer. Rejected equipment may be offered for retest provided all non-compliances have been corrected and retested by the Contractor and evidence thereof submitted to the Engineer.

6. **Warranty.** Guarantee that equipment furnished and installed for this project will perform according to the manufacturer's published specifications. Warrant equipment against defects and/or failure in design, materials and workmanship in accordance with the manufacturer's standard warranty. Assign to the Department all manufacturers' normal warranties or guarantees on all electronic, electrical, and mechanical equipment, materials, technical data, and products furnished for and installed on the project. Repair or replace defective equipment, at the manufacturer's option, during the warranty period at no cost to the Department. Provide equipment with 95% of the manufacturer's standard warranty remaining on the date that equipment invoices are submitted by the Contractor for payment. Any equipment with less than 95% of its warranty remaining will not be accepted by the Department.
7. **Experience Requirements.** Personnel involved in the installation and testing of the "Dual OC-3 ATM MPEG-2 Decoder" must meet the following requirements:
 - Three years experience in the installation and testing of ATM Video Decoders.
 - Two installed systems where ATM Video Decoders, as described within these specifications, are installed and the systems have been in continuously satisfactory operation for at least 2 years. Submit photographs or other supporting documents as proof, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the systems.
 - One system with ATM Video Decoders (which may be one of the two in the preceding paragraph) which the Contractor can arrange for demonstration to the Engineer and/or his representatives.
8. **Training.** Conduct a training class (minimum of 4 hours) for up to 10 representatives designated by Texas Department of Transportation on procedures of installation, operations, testing, maintenance and repair of all equipment specified within these specifications. Submit to the Engineer for approval 10 copies of the training material at least 30 days before the training begins. Conduct training within the local area unless otherwise authorized by the Engineer. Customize the training specifically for the TransGuide System. Videotape the entire training on VHS (1/2 in.) tapes and deliver to TransGuide for later use.

- 9. Measurement.** This Item will be measured as each unit furnished, installed, and tested.
- 10. Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Dual OC-3 ATM MPEG-2 Decoder”. This price is for compensation for equipment, cables and connectors; documentation and testing; and labor, materials, warranty, training and incidentals.

SPECIAL SPECIFICATION

6448

Software System Interface

1. **Description.** Integrate the new, contractor installed Fiber Optic Dynamic Message Sign System(s), Local Control Unit(s), Lane Control System(s), CCTV Field Equipment, and Radar Vehicle Sensing Devices with the existing Mainframe Computer and software located in the TransGuide Operations Control Center.

Do not install any hardware interface between the field controllers and the TransGuide mainframe.

No solutions other than specified within these specifications are acceptable.

Provide and install materials and equipment as detailed in these Special Specifications and as directed by the Engineer.

Provide controller software that interfaces the data stream and protocol as described below.

2. **Fiber Optic Dynamic Message Sign System (DMS).** The following describes the software protocol used to communicate between the Texas Department of Transportation (TxDOT) TransGuide Operations Control Center Mainframe (TOCCM) and the Fiber Optic Dynamic Message Sign System (DMS) controller. The protocol is based on sequences of ASCII characters transmitted via a serial data connection between the TOCCM and the DMS Controller.

- A. **General Command Structure.** Data to be exchanged between the TOCCM and the DMS controller is framed into blocks. Each block is comprised of a header, a data body, and end of block information. The header always starts with "SOH" (Start of Header) followed by the address of the controller. The end of the header is a "STX" (Start of Text) to indicate data follows. The data is placed after this STX character, and before the ETX character, which marks the end of the data body. Following the ETX character is a Block Check Character (BBC). Data transmitted to the controller is framed between two "NUL" characters used for synchronization. Data transmitted from the controller is framed between a leading "NUL" character and a trailing "SUB" character.

The following diagram is what a single transmission block looks like:

NUL --- SOH --- ADDR --- STX --- DATA --- ETX ---BCC ---NUL

Where:

NUL--Synchronization character (Hex 00)

SOH--The ASCII Start-of-Header character (Hex 01)

ADDR--Address of the controller determined as:

A controller address is comprised of two parts. The first part of the address is the physical address of the controller. It is a value between 0 and 255.

The second part of the address is the logical address of the controller. It is usually 01, unless the controller is in configuration mode, then the address is 00.

The controller address is sent over the line as 5 ASCII characters.

STX--The ASCII Start-of-Text character (Hex 02), the STX marks the end of the header and the start of the data

DATA--Data for to be exchanged, its length, format, and contents are dependent on the command type (details provided in the command detail section).

ETX--The ASCII End-of-Text character (Hex 03)

BCC--Block check character (to ensure data integrity). The BCC is computed as the arithmetic sum of all the block characters, up to and including the ETX character. When transmitting using a seven-bit data word, only the seven least significant bits are transmitted.

For the following command:

NUL-SOH-00101-STX-E-ETX-BCC- NUL

The BCC would be:

NUL = 00H

SOH = 01H

0 = 30H

0 = 30H

1 = 31H

0 = 30H

1 = 31H

STX = 02H

“E” = 45H

ETX = 03H

=====

13DH

$BCC=(13DH).AND.(7FH)=3DH$

- B. Communication Termination.** The TOCCM terminates communication with the DMS controller by using an “EOT”(Hex04) sequence. This sequence signals the controller to be ready to communicate with the computer. The sequence does not include a BCC and comprises only of an “EOT” character framed between two “NUL” characters. An example synchronization character string would be:

NUL-EOT-NUL

- C. DMS Controller Modes.** The DMS controller does not synchronously send data to the TOCCM, rather, the DMS controller communicates data in one of two fashions:
- A “SELECTING” mode in which the TOCCM requests the DMS controller to receive data. The following command sequence is sent to place the DMS controller in SELECTING mode:

NUL-SOH-ADDR-SEL-NUL

- A “POLLING” mode in which the TOCCM requests the DMS controller to send data to the TOCCM. The following command sequence is sent to place the DMS controller in POLLING mode:

NUL-SOH-ADDR-POLL-NUL

Note that there are no BCC characters attached to the above sequences.

- D. Command Acknowledgement.** Once a sequence has been sent, either from the TOCCM or the DMS controller, the listener always acknowledges the reception of data. If the reception was correctly received, an “ACK” (Hex 06) is sent over the line. If the reception was garbled or lost, a “NAK” (Hex 15) is sent over the line.

The appropriate character is framed between two synchronization characters as follows:

NUL-ACK-NUL to acknowledge command successfully received

NUL-NAK-NUL to acknowledge command not successfully received

- E. Command Summary.** In general each command starts with a capital letter (its command code), followed by various parameters to form a precise syntax. All commands are embedded between control characters according to the communication protocol discussed in the previous section.

The following commands will be sent from the TOCCM to the DMS controller to control the DMS:

- *Display Command
- *Status Retrieval
- *Lamp Status
- *Day/Night Changeover
- *Abort Sign

- *Clock/Calendar Read Command
- *Clock/Calendar Set Command
- *Overbrightness Setting
- *Echo
- *Simulation Control

The details of each of these commands will be further discussed in the following sections.

F. Command Details. The following sections provide the details for each command that is sent between the TOCCM and the DMS controller.

1. DMS Commands Sent From the TOCCM to DMS Controller. The following commands are sent from the TOCCM to the DMS Controller via the communications line.

The structure of the Display Command is as follows:

Offset	Format	Description
1	B	Command function
2	X	subsign number
3	X	X=0: Deferred display 1: Immediate display
4	X	X=0: Steady message 1: Two alternated messages
5	X	X=0: Text 1 steady 1: Text 2 flashing
6	X	Text 1 flashing time ON 3 <= X <= F (.3 sec <= 1.5 sec.)
7	X	Text 1 flashing time OFF 3 <= X <= F (.3 sec <= X <= 1.5 sec)
8	X	X=0: Text 2 steady 1: Text 2 flashing
9	X	Text 2 flashing time ON 3 <= X <= F (.3 sec <= X <= 1.5 sec.)
10	X	Text 2 flashing time OFF 3 <= X <= F (.3 sec <= X <= 1.5 sec.)
11	XX	Text 1 time ON if alternated 3 <= XX <= FF (.3 <= XX <= 25.5 sec.)
13	XX	Blank time between Text 1 and Text 2 0 <= XX <= FF (0 <= XX <= 25.5 sec.)

Offset	Format	Description
15	XX	Text 2 time On if alternated 3 <= XX <= FF (.3 <= XX <= 25.5 sec.)
17	XXXX	Display time (overall) 1 <= XXXX <= FFFF FFFF = 65534 min. FFFF = infinite
21	X	Brightness of Text 1 X = 0: Normal X = 1: Overbright
22	X	Brightness of Text 2 X = 0: Normal X=1: Overbright
23	X	Text follows or Controller text X = 0: Text follows X = 0: Programmed text
24	XX	Number of characters in Text 1 (hexadecimal ASCII coded format)
26	XX	Number of characters in Text 2 (hexadecimal ASCII coded format)
28	X.....X or XX	N characters describing Text 1 or programmed text number (see 23)
xx	X.....X or XX	N characters describing Text 2 or programmed text number (see 23)

The structure of the reply sent by the DMS controller to the TOCCM is:

Error Free Case:

Offset	Format	Description
1	sent by the DMS	to the TOCCM Function correctly processed
2	0	No error occurred

Error Occurred Case:

Offset	Format	Description
1	b	Error occurred

Offset	Format	Description
2	X	X = 1 : Unknown function code X = 2 : EEPROM parameter code X = 3 : Reset indicator X = 4 : Syntax error in command X = 5 : Undefined subsign X = 6 : Unknown preprogrammed text X = 7 : Length error in command format X = 8 : Text with non ASCII characters X = E : Time not initialized X = F : CAN board no enabled or fault sensor

2. **Status Retrieval.** The status retrieval command provides the status of a DMS or it's associated subsign. The structure of the command status retrieval command is:

Offset	Format	Description
1	C	Command function
2	X	Subsign number 0 <= X <= 7

Note: Subsign 0 indicates the full sign.

Offset	Format	Description
1	C	Function correctly processed
2	XXXX	Remaining display time in minutes (e) 0000: Sign blank
6	X	X = 0 : Sign Off X = 1 : Sign loaded X = 2 : Sign loaded in deferred mode X = 3 : Sign lit X = 4 : Sign busy (=lit)
7	X	X = 0 : Normal Operation X = 1 : Loop-back mode X = 2 : Back-up operation X = 3 : Lamp(s) OUT & OFF X = 4 : Lamp(s) OUT & ON X = 5 : No 48 volts X = 6 : Sign Aborted X = 7 : Bad shutter power supply X = 8 : Simulation mode active
8	X	Display from : X = 0 : Central computer X = 1 : Maintenance Terminal X = 2 : Local Control Panel X = 3 : Remote Control Panel
9	X	Day / Night sensor status X = 0 : Normal mode X = 1 : Day mode

Offset	Format	Description
10	X	Overbright sensor status X = 0 : Normal mode X = 1 : Overbright mode
11	X	Day / Night Command X = 0 : Night command X = 1 : Day command
12	X	Overbrightness Command Status X = 0 : Normal command X = 1 : Overbrightness command
13	X	Day / Night Function Status X = 0 : Automatic mode X = 1 : Manual mode
14	X	Overbrightness Function Status X = 0 : Automatic mode X = 1 : Manual mode
15	X	Shutter Service Status X = 0 : No service in progress X = 1 : Service in progress
16	X	Default Display Status X = 0 : No current default display X = 1 : Current default displayed now
17	17	Shutter Power Supply X = 0 : Power 0 X = 1 : Bad power supply
18	X	Local Display Message Active X = 0 : No local display on X <= C : Message number displayed (1-12) X = D : Not used X = E : Not used X = F : Test message displayed

Error Case:

Offset	Format	Description
1	C	Error occurred
2	X	X = 1 : Unknown function code X = 3 : Reset Indicator X = 4 : Syntax error in command X = 5 : Undefined subsign X = 7 : Length error in command format

- Lamp Status.** The Lamp Status command requests the status of the 12 lamps controlled by a lamp control module. A lamp control module is capable of driving up to 12 lamps.

In a standard DMS configuration, 6 of these lamps are used as primary lamps, and 6 are associated backup lamps. The structure of the command Lamp status command is:

Offset	Format	Description
1	D	Command function
2	X	Lamp control module number X <= X <= 3

The structure of the reply received from the DMS controller is:

Error Free Case:

Offset	Format	Description
1	D	Function correctly processed
2	X	X = 0 : Test performed X = 1 : Test not performed
3	X	X = 0 : Configuration
4		Analog loop-back X = 0 : With loop-back X = 1 : Without loop-back
5	X	48 vilts X = 0 : No 48 volts X = 1 : 48 volts ok
6	XXXXXXXXXXXXX	12 bytes corresponding each to a lamp byte 6 = Lamp 1 Byte 18 = Lamp OUT and OFF For each byte: X = 0 : Lamp OK X = 1 : Lamp OUT and OFF X = 2 : Lamp OUT and ON X = 3 : No significant

Error Occurred Case:

Offset	Format	Description
1	d	Error occurred
2	X	X = 1 : Unknown function code X = 3 : Reset indicator X = 4 : Syntax error in command X = 5 : Undefined subsign X = 7 : Length error in command format

- Day/Night Changeover.** The Day/Night Changeover command activates the Day/Night change over relay. The brightness can be set to either day or night levels. The structure of the command is as follows:

Offset	Format	Description
1	G	Command function
2	X	Change of Day / Night X = 0 Day -> Night X = 1 Night -> Day
3	X	Control X = 0 Automatic Mode X = 1 Forced Mode

The structure of the reply received from the DMS controller is:

Error Free Case:

Offset	Format	Description
1	G	Function correctly processed
2	0	No error occurred

Error Occurred Case:

Offset	Format	Description
1	g	Error occurred
2	X	X = 1 : Unknown function code X = 3 : Reset indicator X = 4 : Syntax error in command X = 7 : Length error in command format X = B : Day/Night change over impossible

- 5. Abort Sign.** The Abort Sign command is sent by the TOCCM to activate the lamp power supply abort relay, thus blanking the sign. The DMS controller should receive any commands sent after an abort command but the commands should not be processed or displayed. A un-abort (an Abort command with the restore option specified) command must be sent by the TOCCM to restore the power to the lamps (and thus the DMS controller should start normal processing again).

The structure of the Abort Sign command is as follows:

Offset	Format	Description
1	H	Command function
2	X	X = 0 48 V cut off X = 1 48 V restored

The structure of the reply received from the controller is:

Error Free Case:

Offset	Format	Description
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Offset	Format	Description
1	H	Function correctly processed
2	0	No error occurred

Error Occurred Case:

Offset	Format	Description
1	h	Error occurred
2	X	X = 1 : Unknown function code X = 3 : Reset indicator X = 4 : Syntax error in command X = 7 : Length error in command format X = C : Abort change over impossible

- 6. Clock/Calendar Read Command.** The Clock/Calendar Read command transmitted by the TOCCM to read the current time and date from the DMS controller's clock/calendar board. The structure of the command is as follows:

Offset	Format	Description
1	L	Command function

The structure of the reply received from the controller is:

Offset	Format	Description
1	L	Command function
2	XX	Seconds (00 <= XX <= 59)
4	XX	Minutes (00 <= XX <= 59)
6	XX	Hours (00 <=XX <= 23) Military Time
8	XX	Day of month (01 <= XX <= 31)
10	XX	Month (1 <= XX <= 12)
12	X	-Day of week (1 <= XX <= 7) CAUTION : Monday = 1
13	X	Initialization X = 0 Not initialized X = 1 Time initialized

Error Occurred Case:

Offset	Format	Description
1	1	Error occurred

Offset	Format	Description
2	X	X = 1 : Unknown function code X = 3 : Rest indicator X = 4 : Syntax error in command X = 7 : Length error in command format X = A : Function not implemented

- 7. Clock/Calendar Set Command.** The Clock/Calendar Set command is issued by the TOCCM to initialize the time and date in the DMS controller's clock/calendar board. The structure of the command is as follows:

Offset	Format	Description
1	M	Command function
2	00	Seconds can not set seconds
4	XX	Minutes (01 <= XX <= 59)
6	XX	Hours (00 <= XX <= 23) Military Time
8	XX	Day of month (1 <= XX <= 31)
10	XX	Month (1 <= XX <= 12)
12	X	Date of Week (1 <= X <= 7) CAUTION: Monday 1

The structure of the reply received from the controller is:

Error Free Case:

Offset	Format	Description
1	M	Function correctly processed
2	0	No error occurred

Error Occurred Case:

Offset	Format	Description
1	m	Error occurred
2	X	X = 1 : Unknown function code X = 3 : Reset indicator X = 4 : Syntax error in command X = 7 : Length error in command line X = A : Function not implemented

- 8. Overbrightness Setting.** The Overbrightness Setting command is issued by the TOCCM to turn on both the normal and backup lamps simultaneously. This is used to obtain a greater brightness (overbrightness mode). The structure of the command is as follows:

Offset	Format	Description
1	R	Command function
2	X	Change of Normal/Overbright X = 0 Normal Mode X = 1 Overbrightness Mode
3	X	Control X = 0 Automatic Mode X = 1 Forced Mode

The structure of the reply received from the controller is:

Error Free Case:

Offset	Format	Description
1	R	Function correctly processed
2	0	No error occurred

Error Occurred Case:

Offset	Format	Description
1	r	Error occurred
2	x	X = 1 : Unknown function code X = 3 : Reset indicator X = 4 : Syntax error in command X = 7 : Length error in command format

9. **Echo.** The Echo command is issued by the TOCCM to return the message being displayed with all associated parameters to the TOCCM. The structure of the command is as follows:

Offset	Format	Description
1	S	Command function
2	X	Subsign number 0 <= X <= 7

The structure of the reply received from the controller is:

Offset	Format	Description
1	P B Q or D	Last display command sent
2	X	Subsign number
3	X	X = 0 : Deferred display 1 : Immediate display

Offset	Format	Description
4	X	X = 0 : Steady messages 1 : Two alternated messages
5	X	X = 0 : Text 1 steady 1 : Text 1 flashing
6	X	Text 1 flashing time ON 3 <= X <= F (.3 sec <= X <= 1.5 sec)
7	X	Text 1 flashing time OFF 3 <= X <= F(.3 sec <= X <= 1.5 sec)
8	X	X = 0 : Text 2 steady 1 : Text 2 flashing
9	X	Text 2 flashing time ON 3 <= X <= F (.3 sec <= X <= 1.5 sec)
10	X	Text 2 flashing time OFF 3 <= X <= F (.3 sec <= X <= 1.5 sec)
11	XX	Text 1 time ON if alternated 3 <= XX <= FF (.3 <= XX <= 25.5 sec)
13	XX	Blank time between Text 1 and Text 2 0 <= XX <= FF (0 <= XX <= 25.5 sec)
15	XX	Text 2 time ON if alternated 3 <= XX <= FF (.3 <= XX <= 25.5 sec)
17	XXXX	Display time (overall) 1 < XXXX < FFFF FFFE = 65534 min FFFF = infinite
21	X	Brightness of Text 1 X = 0 : Normal X = 1 : Overbright
22	X	Brightness of Text 2 X = 0 : Normal X = 1 : Overbright
23	X	Text follows or Controller est X = @ : Text follows X = 1 : Preprogrammed text
24	XX	Number of characters in Text 1 (hexadecimal ASCII coded format)
26	XX	Number of characters in Text 2 (hexadecimal ASCII coded format)
28	X....X or XX	N characters describing Text 1 or programmed text number (see 23)

Offset	Format	Description
xx	X....X or XX	N characters describing Text 2 or programmed text number

Error Occurred Case:

Offset	Format	Description
1	s	Error occurred
2	X	X = 1 : Unknown function code X = 3 : Reset indicator X = 4 : Syntax error in command X = 5 : Undefined subsign X = 7 : Length error in command format X = D : Subsign off

- 10. Simulation Control.** The simulation command allows the TOCCM to control the simulation control of a controller. When a controller enters simulation mode, if the controller is displaying a message, it blanks the sign. From this point forward, any and all messages to be displayed on the sign will be simulated. The controller will report the messages as being displayed, but the sign will remain blank. The sign status reports if the sign is in simulation mode. When the controller is in simulation mode, the sign will display the current message in the controller, or blank the sign if the controller received a blank sign command.

This command exists so that development efforts can be performed on the TOCCM without presenting information to the field DMS signs. The structure of the command is as follows:

Offset	Format	Description
1	Z	Command function
2	X	Simulation mode X = 0 : Exit simulation mode X = 1 : Lamp and shutter simulation

The structure of the reply received from the controller is:

Error Free Case:

Offset	Format	Description
1	Z	Error occurred
2	0	No error occurred

Error Occurred Case:

Offset	Format	Description
1	z	Error occurred

Offset	Format	Description
2	X	X = 1 : Unknown function code X = 3 : Reset indicator X = 4 : Syntax error in command

G. Error Codes. An error free result of the command is a buffer starting with the same upper case letter as the command issued. If no data is expected from the DMS controller, the response is the upper case letter of the command followed by “0” indicating correct processing.

If an error occurred, the lower case letter of the command is followed by an error code. This indicates that the command has not been executed. The following table lists the possible errors that may occur:

Error Code	Description
1	Unknown function code
2	EEPROM parameter error
3	Reset indicator
4	Syntax error in command
5	undefined subsign
6	Unknown preprogrammed text
7	Length error in command format
8	Text with non ASCII characters
9	Unknown MCL (lamp) module
A	Function not implemented
B	Day/Night change over impossible
C	Abort change over impossible
D	Subsign off
E	Time not initialized
F	CAN board not enabled or faulty sensor

3. CCTV Field Equipment. The following describes the software protocol used to communicate between the TransGuide Operations Center (TOC) and the CCTV Field Equipment. The protocol is based on sequences of ASCII characters transmitted via a serial data connection between the TOC and the Video Cameras.

A. General Command Structure. The communication between the TOC and the CCTV Field Equipment can be one-way in either direction or two-way, depending on the specific command. Commands are sent to the CCTV Field Equipment using ASCII characters and one of the following formats:

1. $\$<CODE><TYPE>[DATA]<carriage\ return><line\ feed>$ where each character in the string is OR'ed with 80hex to set the most significant bit.
2. $<CODE>[DATA]$

The CCTV Field Equipment is controlled by sending one or more commands terminated by a $<carriage\ return>$. The commands are not be executed by the camera until the $<carriage\ return>$ is received. After execution, a $<carriage\ return>$ is sent back to the TOC to acknowledge completion.

Note: [DATA] represents 1 or more parameters required by the command. Some commands do not require data. No space is needed before the 1st parameter; if two or more parameters are transmitted, the parameters must be separated by a space.

Important Note: In cases where the host does not monitor responding carriage returns from the controller, the host will not know whether a command line has been completed. Though the controller normally can receive new commands while it is processing previous commands, there is an exception when the controller is processing a preset position recall. During a preset recall, all incoming characters are ignored except for the ASCII abort character, $<CtrlX>$ (hex 18) which tells the controller to abort the recall. If the host unit does not monitor the controller to see whether a recall is complete, it should send a $<CtrlX>$ preceding all command lines. This way, if a recall was in progress, it will be aborted and then the controller will accept the command; if no recall was in progress, $<CtrlX>$ will be ignored. The TOC utilizes this paradigm.

B. Command Summary. The following commands are defined in this document.

- Shutter speed
- Auto black balance
- Auto white balance
- Auto white balance select
- Color bars on
- Gain select
- Menu
- DTL select
- IRIS control
- Title number
- Title up (display the title)
- Title down (turn off the title)
- Title set
- Stop/Start Command
- Auto Setup/File
- Manual Integration
- Backlight Compensation
- Color/Monochrome
- Auto Integration
- Auto Focus
- IRIS data

- Analog data
- Enable pan/tilt table
- Disable pan/tilt table
- Turn wiper on
- Turn wiper off
- Turn camera on
- Turn camera off
- Extend lens to 2X
- Retract lens to 1X
- Set all controls to no motion
- Set pan
- Set tilt
- Set zoom
- Set focus
- Abort command
- Move to preset position
- Move to specified pan, tilt, zoom, focus position
- Store the current position into preset
- Store the specified pan, tilt, zoom, focus into preset
- Query camera for it's pan, tilt, zoom, focus position
- Camera titling
- Set sector limit
- Set sector label
- Delete sector data
- Delete all sector data

C. Camera Commands without Data. Camera Commands without data are sent to the CCTV Field Equipment using the following format:

`$<CODE><TYPE><carriage return><line feed>`

where

\$ will prefix each command,

CODE -- Two characters which specify the command code

(i.e. What the command is),

TYPE -- Two characters which specify the type of command,

<carriage return> <linefeed> will terminate each command, and

each ASCII character transmitted will be logical OR'ed with '80' hex before being sent to the camera by the TOC.

Notes:

- The examples in this document omit the prefix, suffix, and the OR'ing of bits.
- A <carriage return> terminates the set of one or more commands.
- A <carriage return> is returned upon command execution.

1. **Shutter Speed.** The Shutter Speed command is sent by the TOC to change the shutter speed of the camera. The command is structured using the following data:

Code	Type	Description
01	00	Off
	01	Low
	02	Middle
	03	Fast
	04	Auto Shutter

2. **Auto Black Balance.** The Auto Black Balance command is sent by the TOC to enable the auto black balance feature of the camera. The command has the following format:

Code	Type
03	01

3. **Auto White Balance.** The Auto White Balance command is sent by TOC to enable the auto white balance feature of the camera. The command has the following format:

Code	Type
04	01

4. **Auto White Balance Select.** The Auto White Balance select command is sent by the TOC to change the current settings of the auto black and white balance. The command has the following format:

Code	Type	Description
05	00	Off
	01	A
	02	B

5. **Color Bars On.** The Color Bars On command is sent by the TOC to display the color bars. The command has the following format:

Code	Type	Description
08	00	Off
	01	On

6. **Gain Select.** The Gain Select is sent by the TOC to change the gain setting on the camera. The command has the following format:

Code	Type	Description
0A	00	-3 dB
	01	0 dB
	02	+6 dB
	03	+9 dB

Code	Type	Description
	04	+15 dB
	05	+18

- 7. DTL Select.** The DTL command is sent by the TOC to change the DTL setting on the camera. The command has the following format:

Code	Type	Description
17	00	off
	01	-3 dB
	02	0 dB
	03	+3 dB

- 8. IRIS Select.** The IRIS command is sent by the TOC to change the IRIS setting on the camera. The command has the following format:

Code	Type	Description
1B	00	IRIS cap
	01	(Reserved)
	02	Auto
	03	Auto Adjust
	04	Manual

- 9. Title Number.** The Title Number command is sent by the TOC to change the title currently being displayed on the camera. The command has the following format:

Code	Type	Description
1E	00	Page 1
	01	Page 2
	02	Page 3
	03	Page 4
	04	Off

- 10. Menu.** The Menu command is sent by the TOC to display the camera's menu of internal commands. The command has the following format:

Code	Type	Description
0D	00	Menu

- 11. Menu Up.** The Menu Up command is sent by the TOC to have the camera move its current cursor position up when the camera's internal menu is displayed. The command has the following format:

Code	Type	Description
20	01	Up

This command causes the camera to move its current cursor up one position.

- 12. Menu Down.** Menu Down command is sent by the TOC to have the camera move its current cursor position down when the camera's internal menu is displayed. The command has the following format:

Code	Type	Description
21	01	Down

This command causes the camera to move its current cursor down one position.

- 13. Menu Set.** The Menu Set command is sent by the TOC to inform the camera to set the current selection for the current cursor position. The command has the following format:

Code	Type	Description
22	01	Set

- 14. Stop/Start Command.** The Start/Stop command, used in conjunction with the Title set command, is sent by the TOC to have the camera update the title text. The command has the following format:

Code	Type	Description
2C	00	Stop
	01	Start

- 15. Auto Setup/File.** The Auto Setup/File command is sent by the TOC to return the camera to default conditions. The command has the following format:

- 16. Manual Integration Settings.** The Manual Integration Setting is sent by the TOC to change the integration level of the camera to adjust for low light. The command has the following format:

Code	Type	Description
60	00	Off
	02	1/30
	03	1/15
	04	1/8
	05	1/4

- 17. Back Light Compensation.** The Back Light Compensation command is used to enable/disable Back Light compensation to adjust for a bright background. The command has the following format:

Code	Type	Description
61	00	Disable Compensation
	01	Enable Compensation

- 18. Auto Integration.** The Auto Integration command is used to enable/disable Auto Integration to adjust for a low light. The command has the following format:

Code	Type	Description
62	00	Disable Auto Integration
	01	Enable Auto Integration

- 19. Auto Focus.** The Auto Focus command is used to enable/disable Auto Focus. The command has the following format:

Code	Type	Description
63	00	Disable Auto Focus
	01	Enable Auto Focus

- 20. Color/Monochrome.** The Auto Color/Monochrome command is used to enable/disable Auto Color/Monochrome. The command has the following format:

Code	Type	Description
64	00	Disable Auto Color/Monochrome (Color only)
	01	Enable Auto Color/Monochrome

- D. Camera Commands (Requiring Data).** Camera Commands requiring data are sent to the CCTV Field Equipment using the following format:

\$<CODE><TYPE>[DATA]<carriage return><line feed>

where

- \$ will prefix each command,
- CODE -- Two characters which specify the command code i.e. What the command is),
- TYPE -- Two characters which specify the type of command,
- DATA -- Varies based on command being sent. The format for the data will be further described in the following sections.
- <carriage return> <linefeed> will terminate each command, and
- each ASCII character transmitted will be logical OR'ed with '80' hex before being sent to the camera by the TOC

NOTE: The examples in this document omit the prefix, suffix, and this OR'ing of bits. The command string shall have the following format.

- 1. IRIS Control.** The IRIS control command is issued by the TOC to either open or close the camera IRIS. The format of the command is as follows:

Code	Type	Data	Description
27	04	0000	(open) to 03FF (close)

Note: First send 1B04, then 270403FF to go to manual mode and close iris.

- 2. Analog.** The Analog command is issued by the TOC to change various gain settings. The format of the command is as follows:

Code	Type	Data	Description
------	------	------	-------------

Code	Type	Data	Description
28	00	0000	(open) to 03FF (close) Red Gain
	01	0000	(open) to 03FF (close) Blue Gain
	02	0000	(open) to 03FF (close) Green Gain
	03	0000	(open) to 03FF (close) M Ped
	04	0000	(open) to 03FF (close) BPed

E. Pan/Tilt/Zoom and Titling Commands. The commands defined in this section have the following format:

<CODE>[DATA]

Where

- Each command consists of either one or two letters,
- the commands are CASE SENSITIVE,
- any numerical parameters needed for the command are:
 - specified by the string of ASCII digits representing the decimal value. For example, a value of 26 is sent as a '2' followed by a '6', (i.e. hex 32, hex 36).
 - Where a command has more than one parameter, the parameters shall be separated by a space.
 - The numerical parameters follow the command letter(s). A space may be used between the command and the first parameter, but it is not required.
- To complete the command line, a <carriage return> is placed at the end of the ASCII string.

After the command line has been completed by the unit, a <carriage return> will be sent back to the host to acknowledge completion.

IMPORTANT NOTE: The commands in this section DO NOT 1) start with the '\$' character, 2) end with a <line feed>, 3) nor is each ASCII character logical OR'ed with '80' hex.

1. Enable Pan/Tilt Table. The Enable Pan/Tilt Table command is issued by the TOC to enable the pan/tilt table. The structure of the command is as follows:

Code	Data
M	none

- a. Pan/Tilt Table.** Camera motion is controlled by four voltages corresponding to the velocity of pan, tilt, zoom, and focus which are set using the PTZF commands described in the table below. The commands have a single numerical parameter determining the voltage to which the output is set. The value of the parameter is in the range [0, 32767]. 16383 is the value at which no motion occurs. As the value moves away from 16383, the speed of motion increases. The direction of motion is determined by whether the value is greater or less than 16383 as follows:

Command	Less Than (<) 16383	Greater Than (>) 16383
P – Pan	Right	Left
T – Tilt	Down	Up
Z – Zoom	In (Tele)	Out (Wide)
F – Focus	Near	Far

2. **Disable Pan/Tilt.** The Disable Pan/Tilt command is issued by the TOC to disable the pan/tilt table. The structure of the command is as follows:

Code	Data
m	none

3. **Turn Wiper On.** The Turn Wiper On command is issued by the TOC to turn the wiper (located on the outside of the camera housing) on. The structure of the command is as follows:

Code	Data
W	none

4. **Turn Wiper Off.** The Turn Wiper Off command is issued by the TOC to turn the wiper (located on the outside of the camera housing) off. The structure of the command is as follows:

Code	Data
w	none

5. **Turn Camera On.** The Turn Camera On command is issued by the TOC to turn the camera on. The structure of the command is as follows:

Code	Data
V	none

This command shall be acknowledged by a <carriage return>.

6. **Turn Camera Off.** The Turn Camera Off command is issued by the TOC to turn the camera off. The structure of the command is as follows:

Code	Data
v	none

This command shall be acknowledged by a <carriage return>, the camera shall be reset even if Power On/Off is not supported by the camera and the camera IRIS shall be closed even if Power On/Off is not supported by the camera.

7. **Extend Lens to 2X.** The Extend Lens To 2X command is issued by the TOC to engage the 2X lens extender. The structure of the command is as follows:

Code	Data
------	------

Code	Data
X	none

8. **Retract Lens TO 1X.** The Retract Lens to 1X command is issued by the TOC to disengage the 2X lens extender. The structure of the command is as follows:

Code	Data
x	none

9. **Set All Controls To No Motion.** The Set All Controls To No Motion command is issued by the TOC to command the camera to stop (NO MOTION). This should not be confused with moving the camera to a home position. The structure of the command is as follows:

Code	Data
R	none

10. **Abort Command.** The Abort command is issued by the TOC to abort the command currently being processed by the camera. The structure of the command is as follows:

Code	Data
CtrlX	none

Note that if no command is in progress, the abort command is ignored.

NOTE: When received, all commands will be removed from the queue and all motion will stop. Even if no commands are in the queue, the Abort command is acknowledged with a <carriage return>.

11. **Move to Preset Position.** The Move To Preset Position command is sent by the TOC to instruct the camera to move to a predefined preset position. The structure of the command is as follows:

Code	Data
C	n where: $0 \leq n \leq 63$

12. **Move To Specified Pan, Tilt, Zoom, Focus Position.** The Move To Specified Pan, Tilt, Zoom, Focus Position command is sent by the TOC to instruct the camera to move to a specified condition. The structure of the command is as follows:

Code	Data
CX	<p> <t> <z> <f> Where <p> <t> <z> <f> are described in Section 3.6.

13. **Store the Current Position Into Preset.** The Store the Current Position Into Preset command is sent by the TOC to instruct the camera to store the current position in the specified preset position. The structure of the command is as follows:

Code	Data
E	n where: 0 <= n <= 63

- 14. Store Specified Pan, Tilt, Zoom, Focus Into Preset.** The Store Specified Pan, Tilt, Zoom, Into Preset command is sent by the TOC to instruct the camera to store the specified settings into the specified preset. The structure of the command is as follows:

Code	Data
EX	<i>n P T Z F</i>

where:

0 <= n <= 63
 <p> <t> <z> <f> are described in Section 3.6.

- 15. Query Camera for its Pan, Tilt, Zoom, Focus Position.** The Query Camera for its Pan, Tilt, Zoom, Focus Position command is sent by the TOC to instruct the camera to report its current Pan, Tilt, Zoom, and Focus position. The structure of the command is as follows:

Code	Data
ptzf	none

The camera will respond with the following data:

<p> <t> <z> <f> : Where <p> <t> <z> <f> are described in Section 3.6.

- 16. Camera Titling.** The Camera Titling command is sent to define the title for the camera. The title is included in the image transmitted by the camera.

Code	Data
T	<T B> <1 2> <Title Text>

Where:

<T|B> specifies the top or bottom position for the title.
 <1|2> specifies line 1 or line 2 of the title.
 <Title Text> is up to 20 characters of text.

- 17. Set Sector Limit.** The Set Sector Limit command is sent to define the sector limit for a specified sector ID of the camera.

Code	Data
S<L R>	<i>n</i>

Where:

<L|R> specifies the left or right limit for the sector.

<L|R> specifies the left or right limit for the sector.
 $0 \leq n \leq 15$, sector ID.

- 18. Set Sector Label.** The Set Sector Label command is sent to define the sector label for a specified sector ID of the camera. The label is included in the image transmitted by the camera.

Code	Data
ST	n <Label Text>

Where:

$0 \leq n \leq 15$, sector ID.
 <Label Text> is up to 24 characters of text.

- 19. Delete Sector Data.** The Delete Sector Data command is sent to delete the sector data, i.e. sector limits and sector label, for a specified sector ID of the camera.

Code	Data
SD	n

Where:

$0 \leq n \leq 15$, sector ID.

- 20. Delete All Sector Data.** The Delete All Sector Data command is sent to delete all the sector data, i.e. sector limits and sector labels, for all the sector IDs of the camera.

Code	Data
SX	none

- F. PTZF Voltages.** Pan, Tilt, Zoom and Focus voltages are in the range [0, 4095] where 0 typically represents the center position of the full range of motion of a given function. The voltages are actually 12 bit two's complement values, so in essence, the range is [-2048, 2047] which when viewed as unsigned numbers progress from 2048 to 4095, then from 0 to 2047. The following table defines the voltages for Pan, Tilt, Zoom and Focus.

	Position	Voltage
Pan	0 degrees (left)	2400
	174.9 degrees (center)	4095
	175 degrees (center)	0
	360 degrees (right)	1607
Tilt	-90 degrees (down)	2250
	-30.1 degrees (center)	4095
	-30 degrees (center)	0
	40 degrees (up)	1855
Zoom	0% (out/wide)	1825

	50%	0
	50.1%	4095
	100% (full optical zoom)	2600
	2x digital zoom	2400
	4x digital zoom	2200
Focus	Focus In	2500
	Center	4095
	Center	0
	Focus Out	1820

- 4. Lane Control System.** The following describes the software protocol used to communicate between the TransGuide Operations Control Center Mainframe (TOCCM) and the Lane Control Signals (LCS) controller. The protocol is based on sequences of ASCII characters transmitted via a serial data connection between the TOCCM and the LCS Controller.

- A. General Command Structure.** Data to be exchanged between the TOCCM and the LCS controller is framed into blocks. Each block is comprised of a header, a data body, and end of block information. The header always starts with “SOH” (Star of Header) followed by the address of the controller. The end of the header is a “STX” (Start of Text) to indicate data follows. The data is placed after this STX character, and before the ETX character, which marks the end of the data body. Following the ETX character is a Block Check Character (BBC). Data transmitted to the controller is framed between two “NUL” characters used for synchronization. Data transmitted from the controller is framed between a leading “NUL” character and a trailing “SUB” character.

The following diagram is what a single transmission block looks like:

NUL SOH ADDR STX DATA ETX BBC NUL

Where:

NUL -- Synchronization character (Hex 00)

SOH -- The ASCII Start-of-Header character (Hex 01)

ADDR -- Address of the controller determined as :

A controller address is comprised of two parts. The first part of the address is the physical address of the controller. It is value between 0 and 255.

The second part of the address is the logical address of the controller. It is usually 01, unless the controller is in configuration mode, then the address is 00.

The controller address is sent over the line as five ASCII characters.

STX --The ASCII Start-of-Text character (Hex 02), the STX marks the end of the header and the start of the data

DATA -- Data for to be exchanged, its length, format, and contents are dependent on the command type. The general format of the data area is:

<Name><parameter 1><parameter 2>...<parameter n>

Where:

<Name> --- identifies the command. It is formed using only upper case letters, 1 to 8 characters in length.

<Parameters> - are character blocks constructed with:

A mnemonic which is the parameter identifier (using 1 to 8 alphanumerical characters)

the character '='

a set of alphanumerical characters which constitutes the parameter argument.

The parameter separators are formed with one or more space characters (20h). The number parameters used can vary, and is not limited. Several parameters can be used in the same command multiple times. Inside a parameter, no space character are allowed (specifically between the mnemonic and “=” sign or between “=” sign and the arguments). When text is entered, double quotes “ are used to avoid any confusion. The relative position of the different parameters is generally not important.

A response without error has the same structure as the command.

ETX -- The ASCII End-of-Text character (Hex 03)

BCC -- Block check character (to ensure data integrity). The BCC is computed as the arithmetic sum of all the block characters, up to and including the ETX character. When transmitting using a seven-bit data word, only the 7 least significant bits are transmitted.

For the following command:

NUL-SOH-00101-STX-E-ETX-BCC-NUL

the BCC would be:

NUL = 00H

OH = 01H

0 = 30H

0 = 30H

1 = 31H

0 = 30H

1 = 31H

STX = 02H

“E” = 45H

ETX = 03H

====
13DH

$$\text{BCC} = (13\text{DH}).\text{AND}.(7\text{FH}) = 3\text{DH}$$

1. **Communication Termination.** The TOCCM terminates communication with the LCS controller by using an “EOT” (Hex 04) sequence. This sequence signals the controller to be ready to communicate with the computer. The sequence does not include a BCC and comprises only of an “EOT” character framed between 2 “NUL” characters. An example synchronization character string would be:

NUL-EOT-NUL

2. **LCS Controller Modes.** The LCS controller does not synchronously send data to the TOCCM, rather, the LCS controller communicates data in one of two fashions:

- * A “SELECTING” mode in which the TOCCM requests the LCS controller to receive data. The following command sequence is sent to place the LCS controller in SELECTING mode:

NUL-SOH-ADDR-SEL-NUL

- * A “POLLING” mode in which the TOCCM requests the LCS controller to send data to the TOCCM. The following command sequences sent to place the LCS controller in POLLING mode:

NUL-SOH-ADDR-POLL-NUL

Note that there are no BCC characters attached to the above sequences.

3. **Command Acknowledge.** Once a sequence has been sent, either from the TOCCM or the LCS controller, the listener always acknowledges the reception of data. If the reception was correctly received, an “ACK” (Hex 06) is sent over the line. If the reception was garbled or lost, a “NAK” (Hex 15) is sent over the line. The appropriated character is framed between 2 synchronization characters as follows:

NUL-ACK-NUL to acknowledge command successfully received
NUL-NAK-NUL to acknowledge command not successfully received

- B. **Command Summary.** In general each command starts with a capital letter (its command code), followed by various parameters to form a precise syntax. All commands are embedded between control characters according to the communication protocol discussed in the previous section.

The following commands will be sent from the TOCCM to the LCS controller to control the LCS:

The following commands will be sent from the TOCCM to the LCS controller to control the LCS:

- * Activation Command

* Status Request

The details of each of these commands will be further discussed in the following sections.

C. Command Details. The following sections provide the details for each command that is sent between the TOCCM and the LCS controller.

1. LCS Commands Sent From The TOCCM to LCS Controller. The following commands are sent from the TOCCM to the LCS Controller via the communication line.

- a. Activation Command.** The ANM (Activate Numeric Mode) command is issued by the TOCCM to activate a message on a sign. This command defines the display parameters for one or several Display Units. This command defines which symbols to be displayed specifying the preprogrammed page numbers. The response to the ANM command from the LCS controller is:

ANM

The different parameters for the command are:

ID : The access to this command is protected. This parameter is required

ID=idf/pwd

where:

ID ---- is the parameter identifier

= ----- is a separator

idf --- is a 1 to 8 character string (origin identifier)

/ ----- is a separator and is required whether or not a password is used

pwd --- is a 0 to 8 character string (password)

BC: This parameter defines which type of brightness the controller will use (global for all the Display Units). The syntax is:

BC=A (Automatic)

or

BC=N (Night)

or

BC=D (Day)

In the case where BC=A, the result of the command corresponds to the value of the photocell status. If the BC parameter is not used, the current display brightness value is not modified.

AU: This parameter specifies the Display Unit. This parameter may be used more than once in the same ANM command. In this case, each AU parameter effects all the succeeding parameters up to the next AU parameter.

DSP: This parameter defines the display with numerical mode. The syntax of this command is:

DSP-xxx

where:

xxx is a 1 to 3 numerical character string which represents a preprogrammed message number.

LAMPPWR: This parameter controls the power going to the lamp transformer and thus the lamps for the sign. This is a manual way via a software call to turn off power to the lamps. The syntax is:

LAMPPWR=ON Supply power to the lamps.

Or

LAMPPWR=OFF Turn off power to the lamps.

SIMU: This parameter controls the controller's simulation function. When the controller enters simulation mode, all Display Units are turned off. The controller continues to report the status of the Display Units just as if they were lit. The syntax is:

SIMU=0 No simulation

or

SIMU=1 Lamp simulation

Examples:

Command: ANM ID-ATMS/sigma BC=A AU=1 DSP=001
AU=2 DSP=001 AU=3 DSP=005 AU=4 DSP=006

Response: ANM

Command: ANM ID=ATMS/sigma LAMPPWR=ON

Response: ANM

Command: ANM ID=ATMS/sigma SIMU=1

Response: ANM

- b. Status Request.** The Status Request command causes the LCS controller to send the status details of Display Units requested to the TOCCM. Utilizing this command, the TOCCM can request various parameters status from the LCS controller. The different parameters include:

ID: The access to this command is protected. This parameter is required.

ID=idf/pwd

where:

ID ---- is the parameter identifier

= ----- is a separator

idf --- is a 1 to 8 character string (origin identifier)

/ ----- is a separator and is required whether or not a password is used

pwd --- is a 0 to 8 character string (password)

BSC: Request that the current level of the brightness status be returned.

The syntax is:

BSC=?

SIMU: Request that the current status of simulation mode function be returned. The syntax is:

SIMU=?

AU: Request the status of a specified AU when used in conjunction with the DSP and LMP parameters. The syntax is:

AU=?

DSP: Request that the current symbol being displayed, or 0 to indicate the sign is blank, be returned. The syntax is:

DSP=?

LMP: Request the current lamps out of service for each symbol for the specified AU be returned. According to the parameters which are present in the command, the following parameters are returned.

BCS: Reports the type of control and the current brightness level for the sign. The syntax is:

BCS=m/v

where:

m is the type of control. (A is for Automatic and M is for Manual) '/' is a separator

v is the brightness level. (N is for Night and D is for Day)

SIMU: Reports the controller current simulation mode. The syntax is:

SIMU=0

(No simulation mode review)

or

SIMU=1

(Simulation mode active)

AU: Report the Display Unit. The syntax is:

AU=n

where:

n is a Display Unit number

DSP: Reports what symbol is being displayed. The syntax is:

DSP=n

where:

n is the preprogrammed symbol number.

IMP: Reports the lamp which are out of service for the Display Unit and symbol (DSP). The syntax is:

LMP=lamp 1,lamp 2,...,lamp n

or

LMP=OK

Examples:

Command: ST ID=ATMS/sigma BCS? SIMU=? AU=1 LMP=? AU=2
LMP=?

Response: ST ID=ATMS/sigma BCS=A/D SIMU=0 Au=1 DSP=1
LMP=1,2 AU=2 DSP=2 LMP=OK

Command: ST ID=ATMS/sigma AU=1 DSP=? LMP=?

Response: ST ID=ATMS/sigma AU=1 DSP=3 LMP=8

D. Error Codes. If the command cannot be executed, the LCS should send the following response to the TOCCM:

<Name><error code>:<error location>

where:

<Name> is the command name in lower case letters

<error code> is a 1 to 5 numerical character string which defines the error type encountered

:

character is a separator

<error location> shows the character number (calculated from the first character of the name command) where the error was detected.

The following is a list of error codes that the LCS should transmit:

- 1001 - Command name too long (> 8 characters)
- 1002 - Parameter name too long (> 8 characters)
- 1003 - Parameter argument too long
- 1004 - Unknown command
- 1005 - Command not implemented
- 1006 - ID name too long (> 8 characters)
- 1007 - ID name too short (no name provided)
- 1008 - ID password too long (> 8 characters)
- 1009 - Invalid name/password
- 1010 - Required ID parameter not supplied
- 1011 - Access denied
- 1012 - ID name unknown
- 1013 - Invalid ID number
- 1014 - Unknown AU number
- 1015 - Undefined AU number
- 1016 - Number of argument is incorrect
- 1017 - Value out of range
- 1018 - Too many characters
- 1019 - Too many pages
- 1020 - Required DSP parameter not supplied
- 1021 - Argument length incorrect
- 1022 - Wrong parameter name
- 1023 - Invalid argument

5. Local Control Unit. The following describes the software protocol used to communicate between the TransGuide Operations Control Center Mainframe (TOCCM) and the Local Control Units (LCUs). The TOCCM executes a piece of software known as the Local Control Unit Master (LCUM) which communicates to the LCUs installed remotely in the field. The protocol is based on sequences of ASCII data transmitted via a serial data connection between the TOCCM and the LCUs.

A. General Command Structure. The LCUM and LCUs communicate via fixed format messages containing both ASCII and binary formats. These messages have the following generic format:

SOH ID TYPE DATA LRC ETX

Where:

SOH -- The ASCII Start-of-Header character (Hex 01)

ID --- Five characters long field which defines the LCU that the message is addressed to or sent from. Each LCU will have a simple name of the form Unnnn, where nnnn is the decimal representation of a 16 bit number that the LCU considers its name. The name U0000 is reserved for use in the Power Up message.

TYPE -- One character and defines the type of message (details provided in the command detail section).

DATA --- This field may be N/A, and its length, format, and contents are dependent on the message type (details provided in the command detail section).

LRC --- One character longitudinal redundancy check field. The LRC is determined by performing a modulo-256 sum of the eight data bits in all preceding characters in the message (including the SOH).

ETX --- The ASCII End-of-Text character (Hex 03)

B. Command Summary. The following messages will be sent from the LCUM to the LCU:

- * Download Message
- * Poll Message
- * Run Diagnostics Message
- * Reset Message

The following messages will be sent from the LCU to the LCUM:

- * Power Up Message
- * Poll Response (Data) Message
- * Diagnostic Results Message

The details of each of these messages will be further discussed in the following sections.

C. Command Details. The following sections provide the details for each message that is sent between the LCUM and the LCUs.

1. LCUM to LCU Messages. The following messages are sent from the LCUM to the LCU. The LCUM is a software module executing on the TOCCM and transmitting the following messages to each of the LCUs configured into the TransGuide network.

- a. Download Message.** When the LCUM receives the LCU's power up message, or if the LCUM determines that the configuration of the LCU has changed (including device failures), the LCUM will send a download message to the LCU. This message contains the LCU's ID and the configuration of the LCU's 24 input lines (non-trap device, upstream & matching device, downstream & matching device).

The ID, TYPE and DATA areas of the message are structured as follows:

ID: "Unnnn" (LCU specific)
TYPE:"L" (Hex 4B)
DATA: :NAME:LA:LB:LC:....:LX:

Where:

NAME: A five character ID, in the same format as the ID field, to be used by the LCU in its messages to the LCUM.

Lx: A two character field that represents the type of each of the 24 lines, in one of five formats: “NT”, “Ux”, “Dx”, or “FL”, or “XX”, where:

“NT” (Hex 4D54) is a non-trap device line. “Ux” (Hex 55xx) is the upstream line of a pair, whose downstream partner is line x, whose values range from “A” (Hex 41) to “X” (Hex 58).

“Dx” (Hex 44x) is the downstream line of a pair, whose upstream partner is line x, whose values range from “A” (Hex 41) to “X” (Hex 58).

“FL” (Hex 464B) is a failed non-trap, upstream, and downstream line.

Note: If an upstream or downstream line is marked as failed, the partner line will be marked as “NT”.

“XX” (Hex 5858) is a line that is currently unused.

Example:

```
<SOH>U0001LU0001UBDAUDDCUFDEUHDGUJDIULDKUN  
DMUPDOFLNTUTDSNTNTNTNT<LRC><ET>
```

This LCU contains 10 trap pairs on lines 1-20 (with a failure on line 17, forcing line 18 to Non-Trap) and four non-trap devices on lines 21 - 24.

Example:

```
<SOH>U0001LU0001UKULUMUNUOUPUQURUSUTDADBDC  
DDDEDFDGDHDUDHBTBTXXXX<LRC><ETX>
```

This LCU contains 10 trap pairs on lines 1-20, but paired as (1 & 11), (2 & 12), (3 & 13), etc., two non-trap devices on lines 21 and 22, and lines 23 and 24 are unused.

Note that the overall message length is 62 characters long.

- b. Poll Message.** The LCUM will poll each LCU at regular intervals (this interval is under software control on the TOCCM and is nominally set at 20 seconds). The interval can be software adjusted within a range of 10 to 60 seconds.

The ID, TYPE, and DATA areas of the message are structured as follows:

ID: “Unnnn” (LU specific)

TYPE: “P” (Hex 50)

|DATA: :SERIAL:

Where:

SERIAL: A 16-bit cyclical serial number, identifying the specific poll for tracking.

Example: <SOH>U0001P<xy><LRC><ETX>

Note that the overall message length is 11 characters long.

- c. **Run Diagnostics Message.** The LCUM can request the LCU to run one or more of its set of diagnostics. The ID, TYPE and DATA areas of the message are structured as follows:

ID: "Unnnn" (LCU specific)

TYPE: "R" (Hex 52)

DATA: :TESTS:

Where:

TESTS:

A 16-bit mask, where a set bit indicates the corresponding diagnostic should be run.

Example: <SOH>U0001R<<0110000000000000>><LRC><ETX>

This example requests the LCU to run two diagnostics.

Note that the overall message length is 11 characters long.

- d. **Reset Message.** When error conditions are detected on a loop device, the LCUM can request the LCU to reset the line. The ID, TYPE and DATA areas of the message are structured as follows:

ID: "Unnnn" (LCU specific)

TYPE: "S" (LCU specific)

DATA: :LINE:

Where:

LINE: A one- character field that represents the line to be reset. Values from "A" (Hex 41) to "X" (Hex 58), the same line identification used in the Download Message.

Example: <SOH>U0001SB<LRC><ETX>

This example requests a reset on the second line.

Note that the overall message length is 10 characters long.

2. **LCU to LCUM Messages.** The following messages are sent from the LCUs to the LCUM.

- a. **Power Up Message.** The Power Up message is sent by the LCU when it powers up to inform the LCUM that the LCU needs to be downloaded. The message is sent in response to a Poll Messages until the LCU receives a Download Message.

The ID, TYPE and DATA areas of the message are structured as follows:

ID: "U0000" (Hex 5530303030)

TYPE: "U" (Hex 55)

DATA: LCU name, a 16 bit binary number. The first 12 bits are latched for each LCU, with the last four bits being set from a flywheel on the LCU case. The ASCII decimal version of this number shall be used in the ID field of all further messages.

Example: <SOH>U0000U<xx><LRC><ETX>

Note that the overall message length is 11 characters long.

- b. Poll Response (Data) Message.** The LCU shall respond to each poll with a Data message (unless a Run Diagnostic message has been received, in which case the poll response is the Diagnostic Results message). The serial number field of the Data message will be transferred from the Poll message being answered.

The ID, TYPE and DATA areas of the message are structured as follows:

ID: "Unnnn" (LCU specific)
TYPE: "D" (Hex 44)
DATA: :SERIAL"DELTAT:CA:CB:CC:...CX:

Where:

SERIAL: A 16 bit cyclical serial number, taken from the received Poll Message.

DELTAT: A 32 bit integer, representing the time the LCU has been accumulating the counts, in milliseconds.

Cx: A field containing two 32 bit subfields. The format of the field depends on the configuration of the corresponding line from the download message. Lines configured as "NT" or "Ux" contain "vvvvoooo". Lines configured as "Dx" contain "ttttssss". Lines configured as "FL" contain "FAILFAIL". Lines configured as "XX" contain "XXXXXXXXXX". If the LCU detected a problem with a line or resent the line, the field will not contain data but will contain a flag and status code, "nnnncccc", where:

vvvv is the 32-bit integer count of vehicles for the line or pair.

oooo is the 32-bit integer count of total time, in milliseconds, that the device was occupied for the line or pair.

tttt is the 32-bit integer count of vehicles that contributed to the speed time count.

ssss is the 32-bit integer count of total elapsed time between the pair of devices for the pair.

FAILFAIL (hex 4641494B4641494B) is filler for failed lines.

XXXXXXXXXX (Hex 5858585858585858) is filler for unused lines.

nnnn is a 32-bit flag, set to all ones (Hex FFFFFFFF) marking the field as status instead of data.

cccc is a 32-bit field of status codes. The list of possible code values is provided in Subarticle 5.4 of this document.

Example:

```
<SOH>U0001D<xy><time><vvva>oooa<tttb>
<sssb><vvvc><oooc><tttd><sssd><vvve><oooe>
<tttf><sssf><vvvg>>ooog<ttth><sssh><vvvi>
<oooi><tttj><sssj><vvvk><ookk><tttl><sssl>
<vvvm><oomm><tttn><sssn><vvvo><oooo><tttp>
<sssp><FAILFAIL><vvvr><oorr><vvvs><ooos>
<tttt><ssst><vvvu><ooou><vvvv><ooov><vvvw>
<ooow><vvvx><ooox><LRC><ETX>
```

This example uses the configuration from the first download example and matching the Poll Message example.

Example:

```
<SOH><U0001D<xy><time><vvva><oooa> <vvvb><ooob>
<vvvc><oooc><vvvd><oodd><vvve><oooe><vvvf>
<ooof><vvvg><ooog><vvvh><oooh><vvvi><oooi>
<vvvj><oooj><tttk><sssk><tttl><sssl><nnnm>
<cccm><tttn><sssn><ttto><ssso><tttp><sssp>
<tttq><sssq><tttt><sssr><ttts><ssss><tttt>
<ssst><vvvu><ooou><vvvv><ooov>
XXXXXXXXXXXXXXXXXXXX<LRC><ETX>
```

This example uses the configuration from the second download example, matching the Poll Message example, but with a status code on line M.

Note that the overall message length is 207 characters long.

- c. **Diagnostic Results Message.** If the LCU receives a Run Diagnostics message, the LCU shall run the specified self-diagnostic tests and report the results with the Diagnostic Results message in response to the next Poll Message. The LCU shall respond to each poll with a Data Message. The serial number field of the Results message will be transferred from the Poll message being answered.

The ID, TYPE and Data areas of the message are structured as follows:

ID: "Unnnn" (LCU specific)
TYPE: "G" (Hex 47)
DATA: :SERIAL:R1:R2:R3:....:R16:

Where:

SERIAL: A 16-bit cyclical serial number, taken from the received Poll Message.

Rn: A field containing two 32-bit subfields, representing the results of the corresponding diagnostic. Fields for diagnostics that were not run should be cleared to binary 0.

Example:

```
<SOH><U0001G<xy><000a><000a><rrrb><rrrb><rrrc><rrrc>
<000d><000d><000e><000e><000f><000f><000g><000g>
<000h><000h><000i><000i><000j><000j><000k><000k>
<000l><000l><000m><000m><000n><000n><000o><000o>
<000p><000p><LRC><ETX>
```

Note that this example matches the poll message example previously provided.

Note that the overall message length is 107 characters long.

- 6. Radar Vehicle Sensing Device.** The following describes the software protocol used to communicate between the TransGuide Operations Center (TOC) and the Radar Vehicle Sensing Devices if the devices are not connected to Local Control Units via the use of Dual Loop emulation cards. The protocol is based on sequences of ASCII characters transmitted via a serial data connection between the TOC and the devices.

- A. General Command Structure.** The protocol defines a set of messages using ASCII characters. The ASCII code assigns letters, numbers, punctuation marks, and other common characters to the decimal numbers 0 to 127.

ASCII Codes (Decimal) for Select Characters

Character	Line Feed			Carriage Return (‘/r’)					Space		‘~’		
Code	10			13					32		126		
Character	‘0’	‘1’	‘2’	‘3’	‘4’	‘5’	‘6’	‘7’	‘8’	‘9’			
Code	48	49	50	51	52	53	54	55	56	57			
Character	‘A’	‘B’	‘C’	‘D’	‘E’	‘F’	‘G’	‘H’	‘I’	‘J’	‘K’	‘L’	‘M’
Code	65	66	67	68	69	70	71	72	73	74	75	76	77
Character	‘N’	‘O’	‘P’	‘Q’	‘R’	‘S’	‘T’	‘U’	‘V’	‘W’	‘X’	‘Y’	‘Z’
Code	78	79	80	81	82	83	84	85	86	87	88	89	90
Character	‘a’	‘b’	‘c’	‘d’	‘e’	‘f’	‘g’	‘h’	‘i’	‘j’	‘k’	‘l’	‘m’
Code	97	98	99	100	101	102	103	104	105	106	107	108	109
Character	‘n’	‘o’	‘p’	‘q’	‘r’	‘s’	‘t’	‘u’	‘v’	‘w’	‘x’	‘y’	‘z’
Code	110	111	112	113	114	115	116	117	118	119	120	121	122

For example, the character ‘0’ is assigned the decimal number 48. Each message of the protocol consists of a string of ASCII characters. For example, the 3-character string “XA\r” is sent by an application to request the next event data. (The “\r” character is used here and by some programming languages to represent an ASCII “carriage return”. In the ASCII code, a “carriage return” is assigned the decimal number 13.)

When using a polling communication paradigm, the messages can be divided into two groups: requests and responses. Each request-response pair shares the same header substring. For example, both the event data request and response begin with the substring “XA”. The header is at the beginning of each message.

The header is followed by the payload and footer as diagrammed below for the response message: “XA01CB3DC5100AF00370~\r\r”.

Format of Example Message

	Header	Payload	Footer	
			Checksum	Terminator
Example	“XA”	“01CB3DC5100AF00370”		“~\r\r”

The payload is the data portion of the message. The footer is the used to validate and terminate the message. Validation is performed using a checksum on critical information within a message. Some messages (like the “XA” response) have no checksum. However, when used, the checksum is a 4-character hexadecimal string formulated by adding the numerical ASCII codes of all the characters in a critical substring of the message. As an example, if a checksum was calculated on the payload substring above then the checksum would be determined in the following manner:

$$\begin{aligned}
 & \text{Checksum} = \text{'0'} \text{'1'} \text{'C'} \text{'B'} \text{'3'} \text{'D'} \text{'C'} \text{'5'} \text{'1'} \text{'0'} \text{'0'} \text{'A'} \text{'F'} \text{'0'} \text{'0'} \text{'3'} \text{'7'} \text{'0'} \\
 & = 48 + 49 + 67 + 66 + 51 + 68 + 67 + 53 + 49 + 48 + 48 + 65 + 70 + 48 + 48 + 51 + 55 + 48 \\
 & = 999 \quad (\text{Decimal}) \\
 & = 3E7 \quad (\text{Hexadecimal}) \\
 & = \text{“03E7”} \quad (4\text{-character hexadecimal string})
 \end{aligned}$$

Termination of a message is indicated by a terminator substring. For request messages, the terminator substring is “\r”. For response messages, the terminator substring is a “~\r\r”. The device shall return the terminator substring string, however, some devices like an internal CDPD modem will strip off the “~\r” and so only a “\r” will be observed by the receiving application.

The following list of messages is supported. The third column indicates which messages use a checksum.

Message Description	Header	Checksum in Footer
Get Time Interval Data	“XD”	Yes, in Response Only
Get Presence Data	“X1”	No
Get Event Data	“XA”	No
Get Time	“SB”	No

Get Time Interval	“SJS00008E0008”	Yes, in Response Only
Get Baud Rate	“SJS0000970004”	Yes, in Response Only
Get Classification Lengths	“SJS0200000028”	Yes, in Response Only
Set Time	“S4”	No
Set Time Interval	“SKS00008E0008”	Yes, in Request Only
Set Baud Rate	“SKS0000970004”	Yes, in Request Only
Set Classification Lengths	“SKS0200000028”	Yes, in Request Only

B. Retrieving Time Interval Data. Store volume, average speed, occupancy, and vehicle classification statistics for each lane within the device based on a user-configured time-interval, and request this information using the message “XD\r”. The “XD\r” request message will retrieve the most recently generated time interval data packet.

In order to retrieve time interval traffic data previously generated on the device, the “XD” header of a request must be followed by a 4-character index substring. For example, if time interval data is being generated every 5 minutes and the time is now 12:07pm, then sending an “XD0002\r” request will retrieve the traffic data generated at 12:00pm. Furthermore, the traffic data generated at 12:05pm can be retrieved by sending any of the following requests: “XD\r”, “XD0000\r”, or “XD0001\r”.

The time interval for traffic data aggregation can be anything from 5 seconds to 1 month. The time interval is specified by an 8-character substring that contains a hexadecimal number representing the number of seconds in the interval.

The time interval is requested using the “SJS00008E0008\r” command. If the time interval is 1 hour, the response will be “SJ00000E100196~\r\r” (See figure below). The time interval substring is comprised of the first 8-characters of the response following the “SJ”. For the given example, the time interval substring “00000E10” corresponds to 3600 seconds (1 hour) when converted to decimal. A 4-character checksum is appended to the time interval substring. The checksum is calculated on the characters of the time interval substring.

Format of Get Time Interval Response Message

	Header	Payload	Footer	
		Time Interval	Checksum	Terminator
Length	13	8	4	3
Indices	1-13	14-21	22-25	26-28
Example	“SJS00008E0008”	“00000E10”	“0196”	“~\r\r”
Value		1 hour		

To set the time interval, the time interval substring should first be formulated. The four-character checksum is then calculated. In this case, the checksum is calculated starting with the “S” following the “SK” at the beginning of the message. So for the example in the figure below the checksum is calculated on the substring “S00008E00080000001E”. In this example the value of the time interval when converted to decimal is 30 seconds.

Format of Set Time Interval Request Message

	Header	Payload	Footer	
		Time Interval	Checksum	Terminator
Length	13	8	4	3
Indices	1-13	14-21	22-25	26-28
Example	“SKS00008E0008”	“0000001E”	“03EE”	“~\r\r”
Value		30 seconds		

In the event of a success, the response will be “SKSuccess~\r\r”. In the event of a failure, the response will be “SKFailure~\r\r”.

The device must be capable of storing information in flash (non-volatile) data backup which can buffer up to 2480 intervals.

A successful response to a time interval data request will be as follows:

Example of Successful XD Response

```
“XD000000B4100000032004B00660333008F003D200000032004B00660333008F003D
300000032004B00660333008F003D400000032004B00660333008F003D500000032004
B00660333008F003D600000032004B00660333008F003D700000032004B00660333008
F003D800000032004B00660333008F003D3062~\r\r”
```

In the event of a failure, one of three error messages will be returned: empty, invalid, or failure. “XDEmpty~\r\r” is returned if no interval data exists in SRAM or FLASH. “XDInvalid~\r\r” is returned if the index is not valid because it is too large or malformed. “XDFailure~\r\r” is returned if there was a failure while retrieving the interval data from memory.

The payload of a successful response starts after the “XD” header. The 4-character index substring is not present in the response message. As an alternative for sequence verification, the timestamp substring can be checked.

The payload starts with an 8-character **TIMESTAMP** substring that represents the number of seconds from Jan 1, 2000 at 00:00am based on the PC clock’s UTC time. In the above example of a successful XD response, the timestamp substring is “000000B4”. This timestamp translates to Jan 1, 2000 at 00:03am UTC.

The payload of the timestamp substring is followed by up to 8 lane data substrings. The number of lane data substrings in the response depends upon the number of lanes configured on the device. For instance, if only 3 lanes are configured then only 3 lane data substrings will be returned (See below). Each lane data substring is 29 characters long.

Example Format of XD Response

	Header	Payload				Footer	
		Timestamp	Lane Data 1	Lane Data 2	Lane Data 3	Checksum	Terminator
Length	2	8	29	29	29	4	3

The 29 characters of each lane data substring are grouped into 7 segments as diagramed below. In the successful response above, all 8 of the lane data substrings happen to be exactly the same, except for the (underlined) lane IDs. The lane data substring “200000032004B00660333008F003D” for lane 2 is used as the example below:

Format of Lane Data Substring

	Lane ID	Volume	Average Speed	Occupancy %	Small Class %	Medium Class %	Large Class %
Length	1	8	4	4	4	4	4
Indices	1	2-9	10-13	14-17	18-21	22-25	26-29
Example Substring	‘2’	“00000032”	“004B”	“0066”	“0333”	“008F”	“003D”
Decimal Value	2	50 vehicles	75 mph	10.0%	80.0%	14.0%	6.0%

The 1-character **LANE ID** indicates the position of the lane. The closest lane configured is labeled with ID 1. The next closest lane configured is labeled with ID 2, and so on until the last lane.

The 8-character **VOLUME** substring contains a hexadecimal integer that represents the total number of vehicles detected in the lane, during the time interval. In the above figure, the example volume substring “00000032” translates to 50 vehicles.

The 4-character **AVERAGE SPEED** substring contains a hexadecimal integer that represents the average speed vehicles traveled in the lane, during the interval. The speed units are miles per hour or kilometers per hour depending upon whether English or metric units are selected. If English units are assumed, then the example speed substring of the above figure translates to 75 mph.

The 4-character **OCCUPANCY %** substring contains a hexadecimal integer that must be converted to decimal, multiplied by 100, and divided by 1024 to derive the percentage of time lane was occupied during the interval. In the above figure, the example occupancy % substring “0066” translates to 10.0% when rounded.

The 4-character **SMALL CLASS %** substring contains a hexadecimal integer that must be converted to decimal, multiplied by 100, and divided by 1024 to derive the percentage of vehicles whose lengths were classified as small. In the above figure, the example small class % substring “0333” translates to 80.0% when rounded.

The 4-character **MEDIUM CLASS %** substring contains a hexadecimal integer that must be converted to decimal, multiplied by 100, and divided by 1024 to derive the

percentage of vehicles whose lengths were classified as medium. In the above figure, the example medium class % substring “008F” translates to 14.0% when rounded.

The 4-character **LARGE CLASS %** substring contains a hexadecimal integer that must be converted to decimal, multiplied by 100, and divided by 1024 to derive the percentage of vehicles whose lengths were classified as large. In the above figure, the example large class % substring “003D” translates to 6.0% when rounded.

The lane data substrings are followed by the checksum and terminator in the footer as shown in the “Example Format of XD Response”. The checksum is calculated on the payload portion of the packet only. In the “Example of Successful XD Response” figure, the checksum substring is “3062”.

- C. Retrieving Presence Data.** To query the device whether vehicles are present in the lanes being monitored, transmit the message request “X1\r”. The response from the device shall contain a four-character payload substring that contains a hexadecimal integer. The lower 8 bits of the binary representation of this integer indicate the presence of a vehicle in a particular lane. The least significant bit corresponds to the lane closest to the sensor and the most significant bit corresponds to lane farthest from the sensor. If the bit is set then a vehicle is present in that lane.

To illustrate, suppose that a device monitoring a 4-lane highway is queried for presence and responds with the string “X1000A~\r\r”.

Converting “000A” to its binary equivalent yields “00001010” for the lower 8 bits.

The following figure shows how these 8 bits indicate the presence of a vehicle in lanes 1-8.

Example Parsing of Presence Information								
	MSB							LSB
Lane	8	7	6	5	4	3	2	1
Bit Value	0	0	0	0	1	0	1	0
Presence	No	No	No	No	Yes	No	Yes	No

- D. Retrieving Event Data.** Whenever a vehicle leaves the device’s detection zone a vehicle event is generated. A vehicle event message is created and stored for every vehicle leaving the device’s detection zone. The maximum number of events that the device shall buffer is 10.

To query the device whether vehicles events have been recorded in the lanes being monitored, transmit the command message “XA\r”. Only one event can be acquired per request. The first event recorded in the buffer, is the first event returned by the device (First In First Out). Once an event has been requested, it is removed from the device’s buffer. If the event buffer is empty, the response is “XAEmpy~\r\r”. If an event is found, the response message will look something like “XA01CB3DC51AF00370~\r\r”. This response is used as the example below:

Format of Event Data Response Message

	Header	Payload					Footer
		Timestamp	Lane ID	Duration	Speed	Class ID	Terminator
Length	2	8	1	4	4	1	3
Indices	1-2	3-10	11	12-15	16-19	20	21-23
Example	“XA”	“01CB3DC5”	‘1’	‘AF’	‘0037’	‘0’	“~\r\n”
Value		20:54:02:092 UTC	1	437.5 ms	55 mph	Small	

The 8-character **TIMESTAMP** substring contains a hexadecimal integer that indicates the number of 2.5 ms increments since the beginning of the day (UTC time). For example, if the timestamp field contains the string “01CB3DC5”, then the event occurred at 20:54:02:092 UTC time. (This is true as long as the device time is UTC time.)

The 1-character **LANE ID** indicates the position of the lane in device configuration. The closest lane configured is labeled with ID 1. The next closest lane configured is labeled with ID 2, and so on until the last lane.

The 4-character **DURATION** substring contains a hexadecimal integer that indicates the number of 2.5 ms increments that the vehicle was present in the detection zone. A duration substring of “00AF” translates to 175 increments, or 437.5 ms.

The 4-character **SPEED** substring contains a hexadecimal integer that indicates the speed assigned to the vehicle. A speed substring of “0037” equates to a speed of 55 mph, if the units are English.

The 1-character **CLASS ID** indicates the classification of the detected vehicle. The possible classifications are ‘0’, ‘1’, and ‘2’; corresponding to small, medium, and large vehicles, respectively. The classification lengths shall be adjustable.

- E. Retrieving and Setting the Time.** Device clock time is maintained by a hardware timer. This timer provides a resolution of 2.5ms for event data, and 1 second for time-interval traffic data. The clock records time as the number of seconds since Jan 1, 2000 at 00:00am UTC time using a 32-bit integer.

In the event of a power cycle or other irregularity, an application can re-synchronize (set) the seconds count using an “S4” request message. Similarly, an application can retrieve the current seconds count on the sensor using an “SB” request message. The payload for both the “S4” set request and “SB” get response is an 8-character timestamp substring that represents the 32-bit seconds count integer in hexadecimal.

To translate the seconds count to a date and time, the zero-reference point (“00000000” = Jan 1, 2000 at 00:00am UTC) should be used. As an example, a seconds count of “074554BD” translates to Nov 12, 2003 at 20:29:49 UTC. Since the seconds count is a 32-bit integer it will not rollover until the year 2068.

To set the date and time on the device to Nov 12, 2003 at 20:29:49 UTC, send an “S4074554BD\r” request message. In the event of a success, an “S4Success~\r\r” response message will be returned. In the event of a failure, an “S4Failure~\r\r” response message will be returned.

To check the updated time, send an “SB\r” request message. If successful and the date and time is currently Nov 12, 2003 at 20:30:00 UTC, the response will “SB074554C8\r”. In the event of a “SB” request failure the response will be “SBFailure~\r\r”.

- F. Retrieving and Setting the Baud Rate.** The baud rate shall be controllable for the 4 communication ports of the device: RS-232, RS-485, Expansion A (Internal CDPD Modem), and Expansion B. The rates are specified using a 4-character baud rate control substring as specified below. Each character of the substring represents the baud rate of one of the ports.

Format of Baud Control String

	1st Character	2nd Character	3rd Character	4th Character
Port	Expansion B	RS-232	Expansion A	RS-485
Default Code Value	‘1’	‘0’	‘1’	‘4’
Default Rate	19.2 Kbps	9600 bps	19.2 Kbps	115.2 Kbps

Baud Rate Encoding Table

ASCII Value	Rate
‘0’	9600 bps
‘1’	19.2 Kbps
‘2’	38.4 Kbps
‘3’	57.6 Kbps
‘4’	115.2 Kbps
‘5’	230.4 Kbps
‘6’	460.8 Kbps
‘7’	921.6 Kbps
‘8’-‘F’	Reserved

The baud rate control substring is retrieved using the “SJS0000970004\r” request message. If the baud rate control substring is “1414”, then the response will be “SJ141400CA~\r\r”. The baud rate control string is composed of the first 4 characters of the response following the “SJ”. A 4-character checksum substring and the terminator are appended after the baud rate control string. The checksum is the hex representation of the sum of the ASCII values of the baud rate control string.

To change the baud rate for a specific port, the baud rate control string should first be formulated. A four-character checksum is then appended. In this case, the checksum is calculated starting with the “S” following the “SK” at the beginning of the message. For example, to set the baud rate control string to “1014”, the command “SKS00009700041014030D~\r\r” would be sent. Here the checksum “030D “ is

calculated on the substring “S00009700041014”. In the event of a success the response will be “SKSuccess~\r\r”. In the event of a failure, the response will be “SKFailure~\r\r”.

- G. Retrieving and Setting the Classification Lengths.** Specify the classification lengths in feet or in decimeters. There are three classification bins: Class 0 (Small), Class 1 (Medium), Class 2 (Large). A classification bin is defined by specifying a minimum and maximum length of vehicles that will be lumped into that bin. Bins must not overlap each other, or the results will not be as expected.

The classification lengths are specified by a 40-character string. The format of this string is shown below:

Classification Lengths Specification String								
	Class 0 Min	Class 0 Max	Reserved	Class 1 Min	Class 1 Max	Reserved	Class 2 Min	Class 2 Max
Length	4	4	8	4	4	8	4	4
Example	“0000 ”	“000A ”	“0000000 0”	“000 B”	“001E ”	“00000000 ”	“001 F”	“0032 ”

The classification length specification is requested using the “SJS0200000028\r” command. If the classification lengths are: Class 0 [0,10 ft], Class 1 [11,30 ft], Class 2 [31,50 ft], the response will be:

“SJ00000000A00000000000B001E00000000001F003207D5~\r\r”.

The first 40-characters of the response following the “SJ” is the classification lengths specification string. The string contains 6 hexadecimal numbers that are the minimum and maximum lengths in each classification bin. A four-character checksum is appended after the classification lengths specification string. The checksum is calculated on the characters in the classification lengths specification string.

To set the classification lengths, the specification string should first be formulated. A four-character checksum is then appended. For a set command, the checksum is calculated starting with the “S” following the “SK” at the beginning of the packet. In the following example the checksum “0A03” was calculated on the substring:

“S020000002800000016000000000017002800000000002903E8”.

Suppose the classification lengths need to be changed so that: Class 0 [0,22 ft], Class 1 [23,40 ft], Class 2 [41,1000 ft]. In this case, the request message

“SKS020000002800000016000000000017002800000000002903E80A03~\r\r”

should be sent. In the event of a success the response will be “SKSuccess~\r\r”. In the event of a failure, the response will be “SKFailure~\r\r”.

- 7. Measurement and Payment.** The work performed and materials furnished in accordance with this Item shall not be measured nor paid for directly, but shall be considered subsidiary to the governing specifications for the items of construction in which these materials are used.